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Chemical Engineering Conferences

IT is an interesting coincidence that, hardly two months after the O.E.E.C. Conference on the Functions and Education of the Chemical Engineer in Europe, which is just winding up in London as we go to press, another big gathering of chemical engineers —the Congress of the European Federation of Chemical Engineering—will assemble at Frankfurt-am-Main, Germany. However, the two meetings are quite different in their scope and objects. The Frankfurt gathering, to be held from May 14 to 21, has connections with the Achema XI Exhibition and Congress, featured in a special section in this issue. It is sponsored by the 23 scientific and technical societies, from 13 Continental countries, that form the European Federation of Chemical Engineering. Experts from 16 different countries will deliver 19 plenary and 58 open lectures on topics selected from the field of activities of the Federation. This field includes apparatus, machinery, raw materials and auxiliary materials used by chemists and chemical engineers, as well as chemical engineering processes and methods.

Thus it will be seen that the emphasis will be on scientific and technological advances. Not so the London conference, which, drawing attention to the vital importance of chemical engineering in the industrial picture, has been devoted to matters affecting training and research. To appreciate fully its aims, we must go back to the report on ' Chemical Apparatus in the U.S.A.' that was brought out in 1952 by the O.E.E.C. mission to the United States. This report focussed attention on the great strides that chemical engineering has made in America and on the benefits it has brought to industries there. A good part of this report was devoted to the need for more chemical engineers in Europe and made a number of recommendations in this respect. The conference has shown that these have not been forgotten.

The proposal to hold a conference came originally from the Institution of Chemical Engineers, and the conference has been jointly organised by the Institution and the Department of Scientific and Industrial Research. Because the problems associated with chemical engineering are of such great importance to European economy, the conference was subsequently accepted by the Organisation for European Economic Co-operation as a project sponsored by the European Productivity Agency—the executive body of the Organisation.

The O.E.E.C. conference has provided a unique opportunity for the Western European countries to

compare progress, methods and facilities in training. It should result in a much wider understanding of the problems to be faced and overcome. Chemical engineering has an important part to play in the economic welfare of Western Europe. The conference should help each of the countries concerned to play that part more effectively.

Chemical engineering courses in Britain

IN Britain, chemical engineering is taught in the universities of Birmingham, Cambridge, Durham, Glasgow, Leeds, London and Manchester. There are two Chairs of Chemical Engineering in London, one in Birmingham, one in Cambridge and one in Durham. A Chair has now been established at University College, Swansea, and Chairs are being created at Manchester and Nottingham. There are also developments at Edinburgh and Sheffield. Higher National Certificates and other courses are available at a number of the larger technical colleges. The 'H.N.C.' method of entry into the profession is going to play an increasingly important part in the future—provided industry is forthcoming in providing suitable training schemes.

All told, some 320 candidates are qualifying each year in the U.K. Of these, approximately 50 stay on to do research for higher degrees. The development of training facilities, which has been slow, is now increasing more rapidly, but we are still far short of an adequate number of young men of the right calibre.

An interesting development at the University of Durham is the completion of arrangements for what must be the first undergraduate course to be started since the war. This is at King's College in the Newcastle Division of the University, where a postgraduate course in chemical engineering was started in 1947. This course has been of two years' duration and led to the degree of M.SC. in chemical engineering. The work has formed one branch of the Department of Mechanical and Marine Engineering. Following the appointment of Prof. J. M. Coulson as the first Professor of Chemical Engineering, a separate Department of Chemical Engineering and Fuel Technology has been formed.

The new course, which will lead to the honours degree of B.SC. in chemical engineering, will provide a three years' course in the Faculty of Applied Science. For entry to this course candidates are required to have passed the advanced level of the G.C.E. in chemistry, physics and mathematics. Facilities are available in the college for students who have not reached this necessary standard to take a preliminary examination which will bring them up to this standard. This arrangement enables students who have not been able to study all of the subjects to the required level to be accepted on a four years' course.

The department is housed in the fine new Stephenson Engineering Building where the main laboratory is a spacious hall measuring some 110 ft. by 35 ft. In addition to providing the new undergraduate course, the postgraduate course for the M.SC. will still continue for the time being.

Russia's chemical plant exports

THE news that an agreement has been signed between the Government of India and the Soviet Government, providing for the supply and erection of a big steel plant in Madhya Pradesh, India, might foreshadow Russia's entry into the Indian market in the realm of chemical plant also. For Russia's chemical plant industry, which has become practically the sole supplier of all the satellite states, is just beginning to put in an occasional appearance in other areas.

The size and scope of the Russian chemical plant industry would be less remarkable were it not for the fact that, before 1914, the Russians had scarcely any factory manufacturing chemical plant and used to buy most of the equipment for their chemical works from Germany. At the beginning of the second world war they were already more or less independent in this respect. During the war they acquired an abundance of modern technological knowledge through the help they received from the United States and Great Britain in the erection of industrial plants. This was supplemented in 1945 by an enormous number of patents, secret processes, research results and industrial plants which fell into their hands in Eastern Germany and were immediately used to develop Russia's chemical plant industry, with the result that this industry does now supply all the plant and equipment required by the Soviet chemical industry—the second biggest in the world.

In a recent contribution to *Chemische Industrie*, Dr. A. Metzner states that there are about 70 factories in Russia which specialise in the manufacture of plants and machinery for the chemical industry. Six of them are in Moscow, namely 'Sswoboda,' 'Kompressor,' 'Krassny Fakelj,' 'Lepse,' 'Borez' and 'Kalinin.' Two are in Leningrad: 'Naross' and 'Lenin'; and two in Ssumy: 'Frunse' and 'Artjom.' Other works of special importance are: 'Boljschewik' at Kiev, 'Progress' at Berditschew, 'Krassny Oktjabrj' at Fastov (all in the Ukraine) and 'Stalin' at the Black Sea port, Odessa. In 1950 the output of these works was about twice that of 1938 and since then it has increased by another 70%.

Fields in which the Russian manufacturers are particularly active include the production of precision measuring instruments, devices for the automatic control of chemical processes, equipment for petroleum refining and plants for the manufacture of motor fuels. Some of the Russian chemical engineering organisations are at present busy in Poland erecting complete plants for the manufacture of nitrogen compounds, alkalis, sulphuric acid, acetic acid, motor fuels and synthetic rubber.

According to a recent circular from the Board of Trade, London, the steel plant for India in which the Russians are concerned is to have an initial annual capacity of 1 million ingot tons (750,000 tons of finished products—including rails, heavy structural sleeper bars, merchant bars and billets) and over 100,000 to 300,000 tons of foundry pig iron. The plant will be designed with a view to an eventual

Comical Engineering Terms

"HEAT TRANSFER"

expansion to a capacity of 1 million tons of finished steel. A detailed project report is expected to be submitted within nine months and the entire plant is expected to be commissioned by the end of 1959, but some of the main departments will be ready a year earlier. Provision is to be made for the manufacture of as much as possible of the equipment in India and of the training of Indian technicians and the provision of technical advice.

Stress relieving a 40-ft.-diameter vessel

AN inkling of some of the problems that are likely to crop up in the design and construction of Britain's projected atomic power stations has already been gained at the full-scale experimental atomic power plant at Calder Hall, Cumberland, where some interesting experiences have led to the employment of unusual techniques. One such involved an engineering and metallurgical operation which, because of its magnitude, was probably unique. The problem was that of stress relieving the reactor shell—a huge cylindrical vessel made by Whessoe Ltd., 40 ft. in diameter, 60-ft. high and weighing 400 tons. There was no gas-heated furnace sufficiently large to take this vessel, so it was decided to heat it electrically. A network of stainless-steel tubing 2,000 ft. in length was installed inside the vessel. A heavy electric current was passed through this framework, which was raised to red heat. Special arrangements had to be made to make available the 1,500 kw. needed for this.

It took several days to raise the temperature of the steel walls of the vessel to the required temperature, at which the vessel was maintained for some hours to complete the stress-relieving operation. Thereafter it was allowed to cool down very gradually to normal temperature. In order to conserve heat and, even more important, to ensure that the thick steel shell reached a uniform temperature at all points, the whole of the outer surface of the vessel was covered with insulating material several inches thick.

I.C.I. ends Whitby potash operations

AFTER seven years of work, involving an expenditure of over £400,000, the Board of Imperial Chemical Industries Ltd. has reluctantly decided that the company is not in a position to proceed with the development of the North Yorkshire potash deposits. It has become clear that the winning of the deposits would present difficult problems which can only be solved by an organisation familiar with the special deep-mining techniques involved, which I.C.I., as a manufacturer of chemicals, does not possess.

The discovery of the potash deposits in Yorkshire arose from the oil prospecting programme of the D'Arcy Exploration Co. in 1938, in the course of which potash-bearing brine, as well as evidence of deposits of sylvinite (a mixture of sodium chloride and potassium chloride) were found in borings at Aislaby, near Whitby. I.C.I. had examined cores from the D'Arcy Co.'s borings and decided to put down boreholes shortly after the war to discover how much potash-bearing brine was available and to prove the extent of the deposits of sylvinite. All this work was done with the full knowledge and agreement of the Government departments chiefly concerned—that is to say, the Ministry of Fuel and Power, the Board of Trade and the Ministry of Materials.

The borehole programme failed to find any promising potash-bearing brine, but proved the existence of two beds of sylvinite, at depths from 3,500 to 4,500 ft., the lower bed extending over an area of 24 square miles and containing between 20 and 40% of potassium chloride. About 350 million tons of potassium chloride can be regarded as the likely deposit proved and, assuming an extraction efficiency of 30%, about 100 million tons of potassium chloride, or 200 years' home consumption at present levels, can be regarded as existing in north Yorkshire.

The total number of boreholes sunk was eleven—the original one sunk by the D'Arcy Exploration Co., six sunk by I.C.I. and four by Fisons Ltd., who associated themselves with the exploration from 1948 onwards.

I.C.I. converted one of its boreholes into an experimental brine well, and carried on trials for over 16 months in an effort to recover potash by solution of the deposits. The technique of obtaining sodium chloride by forcing water into natural deposits, and so dissolving the salt, is highly developed in I.C.I., and it was hoped that a modification of this method, to suit the extraction of potassium chloride from the mixed deposit, might prove an economical means of recovery. Unfortunately, the brine well experiment proved conclusively that potassium chloride could not economically be won in this way—no means could be found to produce a sufficient concentration of the potassium salt, due to the nature of the sylvinite, which consists of two salts of different solubility.

So far as mining is concerned, I.C.I. and Fisons Ltd. employed consultants to report upon the possibility of winning the potash by that method. Examination of their reports led I.C.I., however, to

the conclusion that exploitation of the deposits could only be carried out by an organisation with extensive deep-mining experience.

Fisons Ltd. have not yet come to any decision as to what they will do in the future. I.C.I. has made it clear that its geological and other technical information is now available to the Government or freely at the disposal of Fisons should they wish to proceed.

Problems of caustic soda industry in India

CAUSTIC soda manufacture is still in its infancy in India and the present demand is, to a considerable extent, being met by imports. In *Chemical Age of India* recently, M. L. Seth has put the present requirement roughly at 55,000 to 60,000 tons, with a possibility of increasing this figure to 92,000 tons in the course of the next five years. He reviews the prospects for developing the caustic soda/chlorine industry in India, pointing out that there is a wide gap not only between demand and production in India, but also between the rated capacity of the available facilities and the actual production achieved. However, it seems that plans are afoot to cover the deficit, one of the most important possibilities being the projected installation by the Government of Saurashtra of a plant to manufacture soda ash, a part of the production of which would be reserved for conversion to caustic soda. A 200-ton/day plant is reported to be under consideration.

One of the main reasons for the slow progress of the industry has been the difficulty of disposing of chlorine which comes as a co-product with caustic soda. This difficulty has also been in the way of putting up biggish units, with the result that all the plants continue to be small ones with capacities ranging from 5 to 10 tons. Production at this level is hardly economical, involving as it does all the usual disadvantages of production on such a small scale. The answer would seem to lie in the establishment of industries to utilise the chlorine and, in particular, plants for the manufacture of bagasse pulp and paper. One such plant has been installed in India and is reported to be working satisfactorily. This type of operation could prove a major method of chlorine disposal.

Making dynamite by remote control

IN chemical works many explosive and highly inflammable substances are handled, and nuclear scientists and engineers are learning to juggle with some even trickier ones, but for sheer unpredictable deadliness there is little to touch the innocent-looking, straw-coloured, oily substance called nitro-glycerine. In the various processes it has to undergo before dynamite and other explosives are produced it has to be handled with the utmost respect.

This makes doubly interesting an account which has appeared in the *Financial Times* of the Montecatini concern's near-robot factory for the manufacture of nitro-glycerine and explosives at Avigliana in Italy. Automisation of the manufacture of nitro-glycerine and of its subsequent stages, up to the moment it becomes dynamite, has recently been completed.

The basic components of nitro-glycerine—nitric acid, sulphuric acid and glycerine—are contained in large, isolated tanks. They are piped separately to the reinforced-concrete nitration chamber where they are combined in large spark-proof metal basins. This operation is followed and controlled from a control room at some distance. Electronic and mechanical devices check and counter-check each other so that a complete picture of what is happening in the nitration chamber is provided for the one man in the control room outside the danger area. The nitro-glycerine thus formed flows to washing tanks where it is purified. From the washing tanks, and suspended in water in the form of an emulsion, the nitro-glycerine is piped down to the four kneading chambers where it is combined with inert absorbent substances, such as kieselguhr, and kneaded into the thick, dough-like compound that is known as dynamite.

The kneading of nitro-glycerine into dynamite is the most dangerous stage of the whole highly dangerous procedure, and it is carried out by remote control using a television camera. The operation takes place in four round, reinforced-concrete chambers buried under nearly 20 ft. of earth. The kneading is carried out in revolving bronze and aluminium basins, which are kept in warm water. Elaborate control devices ensure that kneading can start only when the chamber is empty and completely sealed off. In the control room, which is well out of range of any possible blast, the kneading is watched on a television screen while through a loudspeaker can be heard the slow crunching of the kneaders. Instruments on the control board provide the temperature of the water under the kneading basin, the temperature of the metal itself, of the dough, etc.

Alaska's chemical industry prospects

DEVELOPMENT of a chemical industry in Alaska has been urged by Mr. Charles C. Concannon, chief of the Chemical Division of the U.S. Bureau of Commerce. Writing in *Chemical and Engineering News* he points out that Alaska offers an untouched field for the chemical industry. It is a land rich in most of the valuable raw materials, and a possible source of electric power equal to one-fifth of the total hydro-electric output of the United States lies untapped there. As a first step he proposes the production of nitrogen, which would require large supplies of electric power and provide an incentive for the construction of power plants. Other industries would then be attracted.

An opportunity for small-scale industry would be provided by the development of a process to separate other valuable metals in the gold dredging operation. Nothing like this has been done and it is believed that the profits would be more than double those from gold alone.

The closest approach to a chemical industry in Alaska at present is one paper pulp mill and some mining activity.

The Jacoby Conveyor as a Solids Feeder

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A cheap and easily variable feeder for delivering free-flowing granular materials is often called for. In the coal industry, instances include the addition of flocculating agents to fine coal slurries, the addition of lime and other chemicals to the water in washery circuits and of pitch to coal mixtures before briquetting. In the chemical industry, a frequent need is the treatment of process effluents with carefully graduated amounts of solid compounds such as lime, sodium phosphate, etc. A study of the little-known Jacoby conveyor has revealed that, with this device, the output can be varied in a very reliable manner simply by changing the slope while keeping the speed constant. In this article, the experiments are described, the results are presented, and a comparison is made with the screw conveyor.

THERE is a demand in industry for a feeding device for delivering free-flowing granular materials at a steady, controlled, and reproducible rate, lower than the rate at which the main process ingredients are passing. Often the addition has to be varied in parallel with the rate of flow of the bulk material and it is commonly an important requirement that the rate be restored to its former value immediately the former settings are repeated. Instances of this requirement include water treatment where lime, soda and other powders have to be fed into the raw water at a rate proportional to the water flow; clay preparation when grog has to be added to slip before firing; and sewage dosage where controlled addition of a flocculating agent is necessary.

In the coal industry, an outstanding example which comes to mind is the addition of flocculating agent to fine coal slurry effluents where an exact and simple control would result in a considerable saving. Other examples are the addition of lime to washery water circuits to adjust the *p*H value, and of pitch to coal mixtures before briquetting.

There are several devices which can be employed for this duty, including screw conveyor feeders in which the rate of feed is adjusted by changing the speed of rotation, vibration feeders in which the amplitude can be varied, pushing devices of the piston type of variable stroke and weighing belt appliances in which the weight of a length of loaded conveyor is made to control the flow. Each device has certain disadvantages. For example, the continuous variation of speed needed for the screw conveyor becomes very expensive for small units. Vibration feeders have a fairly limited range of output, while piston devices are intermittent in their action. The belt conveyor unit must be very carefully designed and fabricated if it is to work well and this often means considerable expense to feed quite a small stream of material. In addition, many of the devices require careful calibration for any particular application and after an adjustment of the operating variables they need a period to ' settle down ' before the flow again becomes steady.

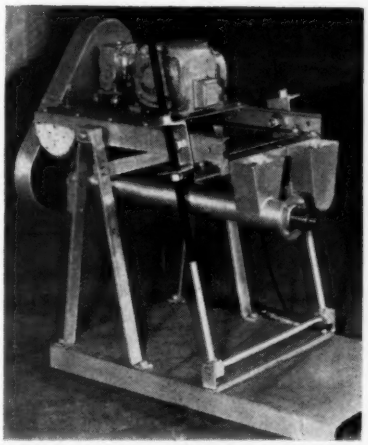


Fig. 1. In the experiments described, the apparatus comprised a Jacoby conveyor and a screw conveyor mounted together on a stand as shown. The Jacoby conveyor is partly hidden.

The screw or worm type of conveyor is well known to engineers and has a very long history. The Jacoby-type conveyor, which consists of a spiral flight fixed inside a rotating tube, is not so well known. This conveyor has been used very occasionally for grain handling, and for moving hot dusty calcines where freedom from internal bearings and prevention of dust escape are obvious attractions. The device is only suitable for conveying free-flowing materials, and the speed of rotation must not be too high or transport will cease, due to centrifugal action. According to Zimmer,* the best flight diameter to employ is one-third of the internal diameter of the tube.

Since the Jacoby conveyor depends primarily on gravity for its action, it seemed that varying the inclination should provide a simple means of changing its output. Evidently it would be easier to arrange for the slope of a small conveyor to be altered than for a speed change to be made. A brief investigation of the characteristics of the Jacoby conveyor was therefore undertaken.

Experimental apparatus

Fig. 1 is a photograph of the apparatus used: a Jacoby conveyor and a screw conveyor of rather similar dimensions mounted on a simple type of angle framing built in the shape of a platform. By means of an A-frame and two hinged, screwed, steel columns, the slope of the conveyors could be varied between 45° conveying upwards and 45° conveying down-

*G. F. Zimmer, ' Mechanical Handling and Storing of Materials,' Darien Press, Edinburgh, 1931.

wards, the slope being indicated by a plumb-line and protractor. The conveyors were fitted with sprockets carrying 110,046 × ½-in. pitch 'Renolds' chain and revolved together at the same speed and in the same sense. The screw conveyor was driven by a similar chain from the output shaft of a Croft 30-to-1 worm gearbox in turn driven by a V-belt from a 1-h.p. motor (three-phase, 1,440 r.p.m.). The ratio of speed between the motor and gearbox was $1\frac{1}{8}$ to 1. Speed variation was arranged in the drive between gearbox and screw conveyor.

The Jacoby conveyor was a mild-steel tube 3 ft. 3 in. long and of $2\frac{3}{4}$-in. bore, containing a welded continuous spiral helix (pitch $1\frac{1}{4}$ in.) consisting of a steel strip $\frac{3}{8}$-in. wide and $\frac{5}{16}$-in. thick. The tube was mounted inside two single-row, double-purpose ball bearings of 3-in. bore and $5\frac{3}{4}$-in. o.d.

The screw conveyor had a shaft $1\frac{1}{4}$ in. in diameter and was fitted into a similar steel tube, the width of the helix in this case being $\frac{1}{4}$ in., while the pitch was $1\frac{1}{4}$ in. The conveyors were mounted with their axes parallel and at the same height.

For the Jacoby conveyor to give reproducible results as a feeder it must be supplied with all the material that it can convey at any particular angle. This is best achieved by providing at the charging end surplus material which can flow backwards against the flight travel and eventually flow out of the conveyor at the inlet end. These conditions can only obtain when conveying upwards at angles between level and 90°. In practice the highest inclination used was 40°, since the output was negligible at greater angles.

When received, both conveyors, as shown in Fig. 1, were fitted with choke-type inlet boxes. For these experiments the inlet box of the Jacoby conveyor was replaced by an open chute made of thin sheet metal bolted to the conveyor framework. The section of the chute contracted quickly from a width similar to the conveyor diameter to a narrow channel which could be inserted into the central opening of the conveyor. Material was propelled into this section of the chute by a tool comprising a disc mounted on a rod. Up to conveyor speeds of 40 r.p.m., a smooth overflow could be ensured and the flights consistently and uniformly filled.

Later, after the main research had been completed, a charging arrangement was developed which, while accepting a choke feed, filled the flights without overfilling. Fig. 2 shows two sectional views of this accessory.

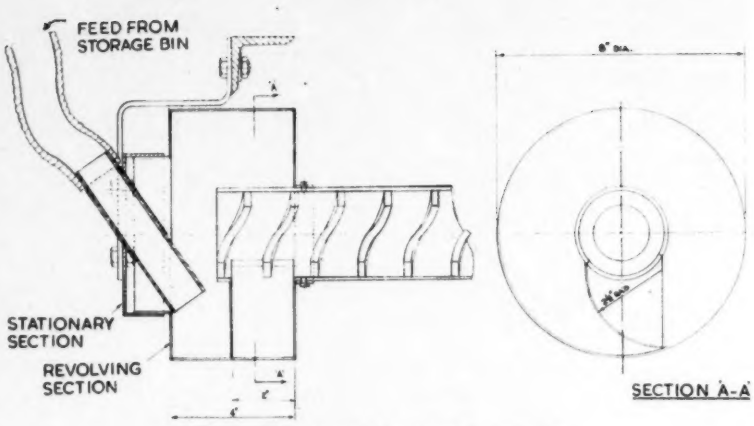


Fig. 2. New feeder for Jacoby conveyor.

The employment of a Jacoby conveyor as a feeder is critically dependent on the correct design of a charging unit.

Procedure

The method of experimentation was to determine the conveying capacity of the Jacoby conveyor for granular anthracite and barytes of between ¼ in. and $\frac{3}{16}$ in. for various angles of inclination. The anthracite had a bulk density of 44.9 lb./cu.ft., while the barytes had a bulk density of 133.8 lb./cu.ft.

After allowing a sufficient period for the flow through the conveyor to become uniform, the product discharged in a fixed time was collected in a tared vessel and weighed. The capacity so determined will be called the 'observed output.'

It is of interest to compare this with the volumetric capacity for a liquid, the increments of which move upwards with their top surfaces horizontal. Simple experiments, using a short section of the flight of the Jacoby conveyor cemented inside a semi-cylinder, enabled these values to be determined for different slopes.

Experimental results

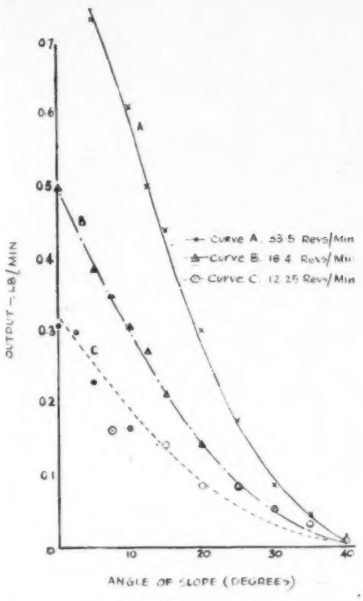
The carrying capacity of the Jacoby conveyor as determined by experiment is given in full in Fig. 3 for anthracite and in Fig. 4 for barytes; a selection of the more important data is set out in columns *A*, *B* and *C* in Table 1.

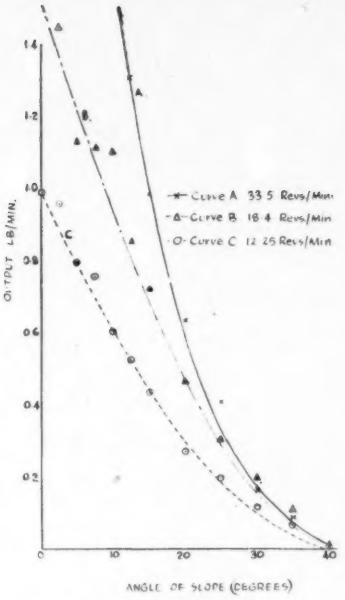
The wide range of capacity available between horizontal and, say, 30° slope is notable. For example, by operating the conveyor at 12.25 r.p.m., the output of anthracite varies from 0.31 to 0.035 lb./min. By increasing the speeds to 18.4 and 33.5 r.p.m., the maxima are raised to 0.5 and 0.97 lb./min., respectively.

The mode of action of an internal helix conveyor is not difficult to understand. Slugs of material trapped in the flight spaces are carried upwards by the rotation of the conveyor. These slugs are largest when the conveyor is horizontal and become smaller as it is tilted. There is no reason to expect

Table I. Conveying Capacity of Jacoby Conveyor

	Capacity (lb./min.)			*Capacity (lb./rev.)*		
Column ..	*A*	*B*	*C*	*D*	*E*	*F*
Speed, rev./min.	12.25	18.4	33.5	12.25	18.4	33.5
Anthracite						
Level ..	0.31	0.5	0.98	0.025	0.027	0.029
10° slope ..	0.17	0.306	0.61	0.013	0.017	0.018
20° slope ..	0.087	0.144	0.3	0.0071	0.0078	0.0089
30° slope ..	0.035	0.056	0.09	0.0028	0.0030	0.0027
40° slope ..	0.0068	0.013	0.02	0.00055	0.000706	0.00059
Barytes						
Level ..	0.99	1.59	2.38	0.081	0.086	0.071
10° slope ..	0.606	1.10	1.71	0.049	0.059	0.051
20° slope ..	0.27	0.47	0.64	0.023	0.026	0.019
30° slope ..	0.12	0.2	0.17	0.0098	0.0109	0.0051
40° slope ..	0.007	0.02	0.05	0.00057	0.00108	0.0015





Figs. 3 and 4. Output curves for Jacoby conveyor using (*left*) anthracite and (*right*) barytes.

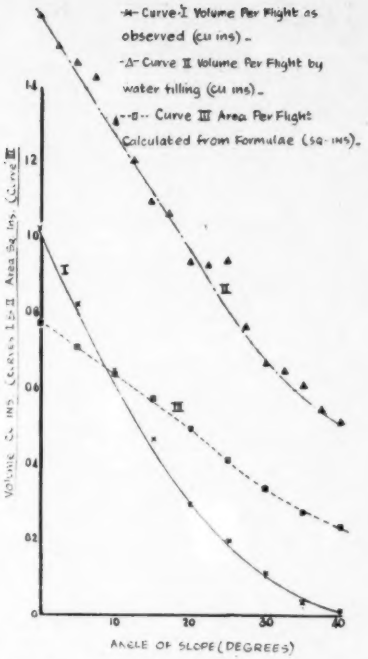


Fig. 5. Jacoby conveyor: relationship between slope and volumetric capacity.

that at any particular slope the amount of material in the increment or slug should be altered by varying the rate of rotation of the conveyor. That this is broadly true will be seen from an inspection of columns *D*, *E* and *F* of Table 1.

Taking into account the bulk densities of the two materials used, the volumetric capacity of the conveyor can be computed and is set down in Table 2.

Table 2. Volumetric Capacity of Jacoby Conveyor

Slope (deg.)	*Cubic inches per revolution*		
	Anthracite	*Barytes*	*Average*
0	1.038	1.021	1.029
10	0.615	0.688	0.651
20	0.304	0.285	0.294
30	0.107	0.118	0.112
40	0.023	0.0137	

It will be seen that, except at the extremely steep slope of 40°, it is almost the same for the anthracite and barytes and it is therefore possible to define the performance of the conveyor quite simply in terms of the average volume per revolution, as shown in the final column.

This most important relationship, the variation of volumetric capacity with slope for granular materials, is shown graphically as Curve I in Fig. 5. Curve II shows the relationship between the slope and the volumes obtained by water filling, as described in the previous section. The area of section of the granular material in a compartment between flights in a vertical plane through the axis of the conveyor, which decreases progressively as the conveyor is tilted, can be calculated using the construction shown in Fig. 6. These areas are included as Curve III of Fig. 5.

As the slope of the conveyor is increased the curve of volumetric capacity in terms of granular solids (I) falls away somewhat faster than the curve of liquid volumes (II) and much faster than that of sectional areas (III). This is not surprising. The form of the increment or slug of the particulate solid is complex and a certain amount of by-passing of material backwards from compartment to compartment may occur.

Using the information in Figs. 3, 4 and 5 and the notation in Fig. 6, the following formulae are derived for the operation of an internal helix conveyor:

$$\text{Output (lb./min.)} = K_1 \rho n b \left(a - \frac{b}{2}\tan\alpha\right)$$

$$\text{or output (lb./min.)} = K_2 \rho n \frac{a^2}{2} \cot\alpha$$

where ρ = bulk density of conveyed material (lb./cu.ft.); n = speed of rotation (r.p.m.); α = angle of slope or inclination to horizontal (deg.); a = depth of ribbon flight (in.); and b = pitch of ribbon flight (in.).

For the specific conveyor used in this research, which had the dimensions and constants set down below, the first formula applies up to a slope of 27° and the second for steeper inclinations.

$a = 0.625$ in. $\quad K_1 = 0.001$

$b = 1.25$ in. $\quad K_2 = 0.003$

The volumetric capacity of a Jacoby conveyor, the leading dimensions of which have already been given, is set out in the following table:

Angle (degrees)	*Cubic inches per revolution*
0	1.03
5	0.88
10	0.65
15	0.46
20	0.29
25	0.19
30	0.11

Comparison with screw conveyor

Some ancillary tests were performed on the screw conveyor using anthracite screened between ½ in. and ¼ in. as the conveyed medium. The results are illustrated in Fig. 7, the speeds used ranging from 33.5 to 98.8 r.p.m.

The output is roughly proportional to the speed over the entire range of inclinations, but the relationship is best followed between 15° conveying

Table 3. Outputs of Jacoby and Screw Conveyors

Output (lb./min.)	*Angle of inclination of Jacoby conveyor*	*Speed of screw conveyor (r.p.m.)*
0.2	24°	1.4
0.4	17°	2.8
0.6	10.5°	4.2
0.8	4.5°	5.6
1.0	Level	7.0

upwards and 15° conveying downwards. For angles between 15 and 30° conveying upwards the output falls off rather more rapidly than the speed dictates, while at the other extreme between 15 and 30° conveying downwards there is a somewhat larger output than that given by speed calculations. These anomalies at large angles may be ascribed to slippage.

It will be noted that the scatter of experimental points is greater with the screw than with the Jacoby conveyor, and also that with the former the scatter is greater at higher than at lower speeds.

It was also found that with the screw conveyor the flow of material was not very reproducible when previous settings were restored.

In order to provide a comparison between the performance of dimensionally similar screw and Jacoby conveyors at one particular speed for the latter (18.4 r.p.m.), Table 3 connects the throughput of the machines used in the present investigation with angle in the case of the Jacoby and speed in the case of the screw conveyor. The material conveyed was anthracite.

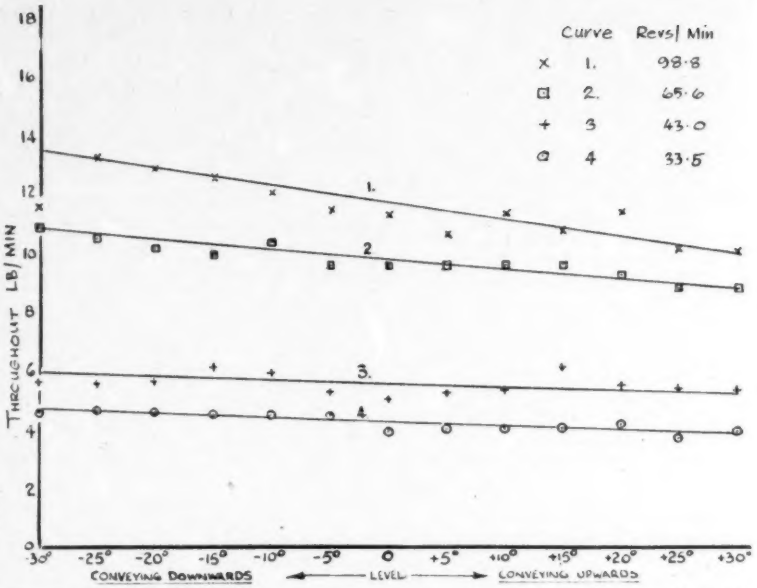
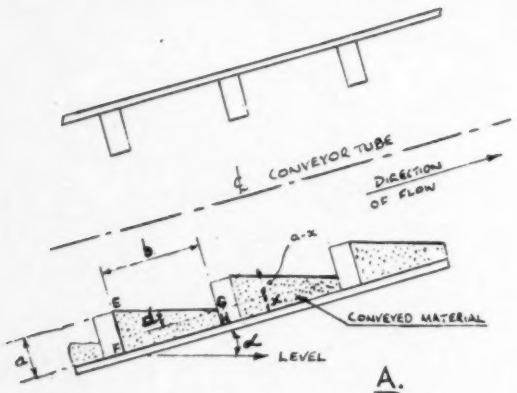


Fig. 7. Screw conveyor. Output curves at various speeds, using Llandebie anthracite $-\frac{1}{2}$ in. $+\frac{1}{4}$ in., speeds from 33.5 to 98.8 r.p.m.

Acknowledgments

The authors wish to express their thanks to the National Coal Board for permission to publish this paper. The views expressed in it are those of the authors and not necessarily those of the Board.



When in position shown at 'A'

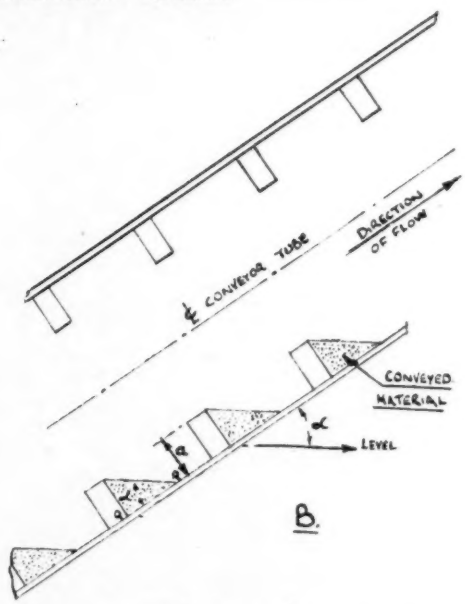
$$\text{area of } EFGH = \frac{b\,(a-x)}{2} + bx$$

$$= b\,(a - \frac{b}{2}\tan\alpha) \quad \ldots\ldots\ldots\ldots \quad (1)$$

When in position shown at 'B'

$$\text{area of } PQR = \frac{a^2}{2}\cot\alpha \quad \ldots\ldots\ldots\ldots\ldots \quad (2)$$

At some stage in the tilting process equation (1) must be equal to equation (2) and we have:



$$b\,(a - \frac{b}{2}\tan\alpha) = \frac{a^2}{2}\cot\alpha$$

This can be solved for any particular values of a and b.
For the conveyor which is the subject of this research a = 0.625 in. and b = 1.25 in. These values give $\alpha = 26° 36'$.

Fig. 6. Diagrams of two different inclinations of the Jacoby conveyor, illustrating geometry of flight spaces.

CENTRIFUGING

I. New machines for industrial and laboratory use; application in oils and fats, soap and sugar industries

By E. Broadwell

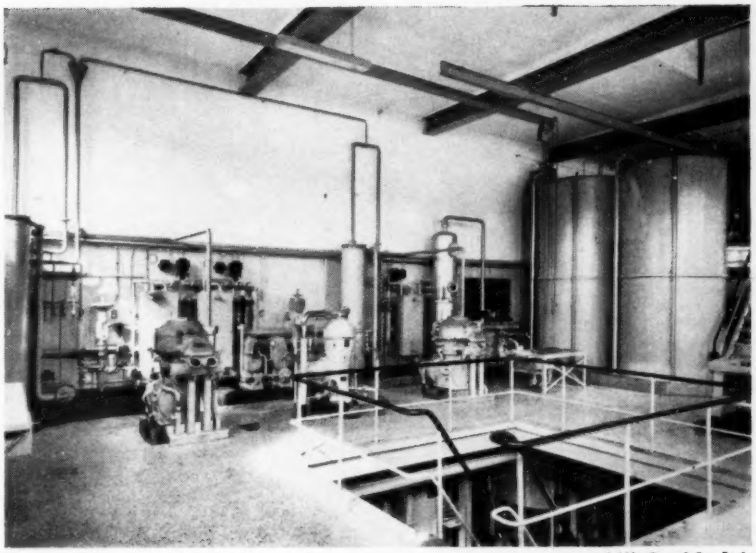
LITTLE fundamental work has been published during the period under review,* but a steady flow of reports of a general character and an increasing number of applications and patents, particularly in the vegetable oil field and chemical industries, make their contribution to progress in this unit operation.

Grace[1] has covered fundamental work similar to that already reported by Storrow *et al.*, using a perforated basket machine; equations of comparable character were developed, but the experimental results show some differences which are probably due to variation in technique.

Details of four Escher Wyss models have been given thorough treatment by Ruegg;[2] these include the conventional vertical and screw type of machines and the more modern scraper and single-stage push types. The article should be of interest to all users of this type of equipment as it presents, in a lucid form, valuable information of a critical nature which has a tendency to be overlooked. The advantages and limitations of the various machines are outlined and, together with the information on operating technique and ancillary equipment, provide a good basis for satisfactory installation and operation of these types of machines. Two recent reports of a more concise character describe the development of the continuous multistage push-type centrifuge made by the same company.[3, 4]

Dolton[5] has published a further review describing the application of various types of De Laval machines in the process industries and includes reference to a new self-opening separator (*q.v.*). Two further reviews by Maloney[6, 7] briefly but adequately summarise the developments which are taking place mainly in the United States.

An article describing separation processes in the food industry by Sellers[8] contains a section devoted to centrifuges of the disc and tubular type and their relative merits; on balance it appears that the disc type finds greater favour. A general description of the Sharples tubular bowl centrifuge and its variations has appeared.[9] Two books recently published contain information of some value; one describes centrifuges for varnish clarification,[10] while the other[11] contains more general information, but, unfortunately, gives somewhat limited coverage of a rather wide field.



[*Alfa-Laval Co. Ltd.*

Typical one-unit installation for refining vegetable oils by the 'Short Mix' process, showing degumming re-refining separator, hermetic soapstock/oil separator, and wash water separator.

Laboratory machines and methods

There have been several developments in this sphere and the most publicised concerns the availability of a new Westfalia multi-purpose laboratory separator, type LWA-205.[12–16] The machine is supplied with four interchangeable bowls with all contact parts of stainless steel; these provide facilities for mixing, solvent extraction, clarification and concentration of solids; the latter operation depends on the use of a nozzle-type bowl with non-peripheral discharge of solids. The unit is therefore quite versatile and, with bowl speeds of 12,000 r.p.m. developing a centrifugal force of 7,500 times gravity, it should be capable of effecting efficient separation; it is to be hoped that data obtained on the small unit will be capable of direct translation to full-scale machines, a point which is often overlooked in laboratory machines of this type.

Two new tube machines for specific use in the petroleum field have been announced; one is British made and suitable for all I.P. tests[17, 18] and the other designed for use in the American oil fields.[19] Two other MSE models using angle heads are the type 13, which takes 8 × 50 ml. tubes at 13,000 r.p.m.,[20] and the 'Refrigerator,' with a capacity of 3 litres.[21] A more specialised apparatus for centrifugal freeze-drying under vacuum has also

*The last Chemical Engineering Review of 'Centrifuging' appeared in CHEMICAL & PROCESS ENGINEERING, 1953, **34** (3), 78.

been reported;[22] centrifugal force suppresses frothing whilst under vacuum, and such a unit is suitable for the preservation of viruses, yeasts, bacteria, etc., in ampoules. Two other new American units include an ultracentrifuge taking 3 × 5.5 ml. tubes up to a force of 178,435 times gravity[23] and a microcentrifuge for 8 × 1 ml. tubes at 23,000 r.p.m.[24] Specialised tubes for use with laboratory machines include an improved recrystallisation tube,[25] a partition cell[26] and a synthetic boundary cell for use with ultracentrifuges.[27]

Laboratory methods involving centrifuging include the determination of acetone insolubles of lecithin,[28] trace metals in petroleum fractions,[29] bile acids in serum,[30] a semi-mirco system for silicate analysis,[31] soil evaluation[32] and particle size between 1 and 0.1 μ[33]

New industrial developments

Two new De Laval machines include a self-opening disc-type separator which intermittently discharges solids automatically when the bowl is opened hydraulically whilst rotating at full speed; it is intended for clarifying or separating all types of liquids in which a fairly high percentage of solids is present and where the bowl-cleaning frequency of a standard high-speed machine would be uneconomical.[34] The other machine is also for treating liquids of high sludge content where a continuous discharge of both liquid and solid is required. It is classified as a desludger and is the horizontal bowl type fitted with an internal conveyor for moving the solids from the bowl wall to the discharge ports; the centrifugal force developed is in the region of 2,000 times gravity and as such will only be suitable for fairly readily separable solids.[35] Another De Laval machine finding wider application in industry is the hermetic clarifier; the liquid under treatment does not have any contact with air and this is of considerable advantage for many of the more specialised problems being encountered today; it is ideal for treating any materials containing inflammable solvents or having an obnoxious smell and where aeration, oxidation or bacterial contamination would be detrimental.[36]

Sharples have also announced three new machines recently; one which has received most publicity is the British-made type 18V.[37–42] It is larger and has, therefore, a higher capacity than the existing Sharples machines, but otherwise has the conventional tubular type of bowl which in this case rotates at 15,000 r.p.m. and develops a force of 13,000 times gravity. A more interesting development concerns a pilot-plant-scale Super-D-Canter model P-4.[43] This is a scaled-down version of its industrial counterpart and is suitable for processing quantities as small as 5 gal. It is claimed that the results from this model can be directly translated to the industrial machine and it will thus be ideal for new projects where only small quantities are available and also eliminate expensive experimental field work with full-size units.

Countercurrent liquid-liquid centrifugal extractors continue to receive attention and a new machine in this field is the Sharples 'Super-Centactor.'[44] This is a forerunner of a larger model which is under development and can be arranged with up to five stages in a tubular bowl 8-in. long by $1\frac{3}{4}$-in. diameter, with a variable centrifugal force from 620 to 15,000 times gravity. In each stage there is a mixing chamber with a blade attached to a stationary centre shaft creating turbulence in the mixture entering the zone between adjustable baffle plates. These form the top and bottom of successive separating chambers. Both liquids enter the bottom of the bowl, the light liquid travelling to the top *via* the stationary centre shaft; after extraction the heavy phase discharges from the top and the light phase from the bottom over adjustable dam rings.

Further developments have also been announced for the Luwesta centrifugal extractor; a pilot-plant model, type EG2006, is now available having a throughput up to 240 gal./hr.;[45] patents also cover minor improvements to the larger unit.[46, 47] Other types of liquid-liquid extractors have also been patented, one making use of perforated plates and radial baffles[48] and another with provision for increasing the rate of extraction by periodic magnetic movement of iron particles through the interface.[49]

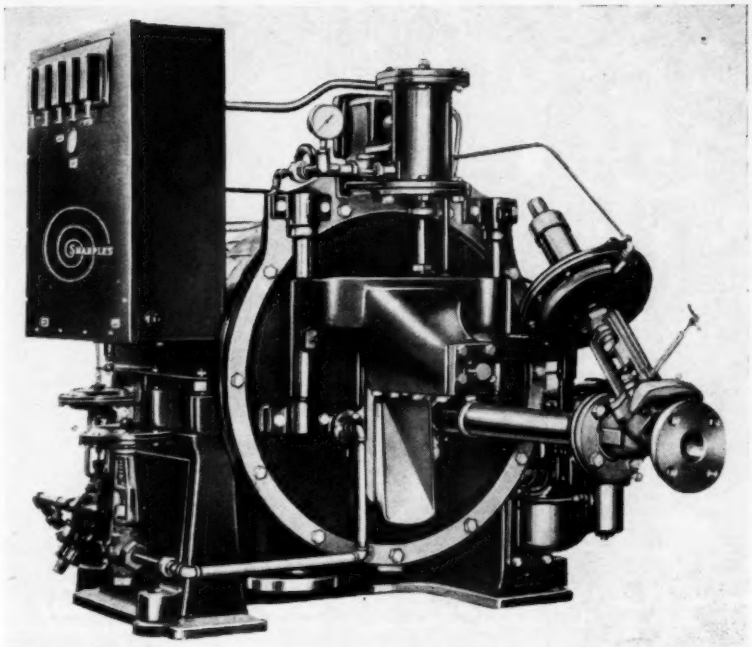
A further new high-speed machine is a Werkspoor model;[50] this is a nozzle-type separator, but its precise function has not been fully explained. In addition, a new machine of the horizontal-bowl continuous type has been described;[51] it is similar to a number already on the market, but includes the extra provision of a hydraulic device for varying the speed differential between the conveyor and bowl shell.

Several new basket machines have been developed, but these are mainly for the sugar industry and are described under that section. Mention should be made, however, of a new 21-in. Broadbent model, type 26, which has been developed for process engineering.[52] Patents cover a fruit pulp centrifuge with a device for removing pulp residue so as to prevent blocking the cage perforations,[53] and a machine with an inner pervious partition through which the liquid flows.[54]

The Glacier metal filter is a novel centrifuge employing a well-known but seldom practised principle for driving the bowl.[55–57] It is designed for clarifying lubricating oil in systems where the oil is circulated under pressure; the oil is pumped into the bowl and discharges through nozzles, the reaction of which supplies the power to drive the bowl. Its minimum working oil pressure is 30 p.s.i., at which the bowl rotates at 3,500 r.p.m. and clarifies the oil at 55 gal./hr.; higher pressures give corresponding increase in bowl speed and throughput.

Vegetable oil

Considerable developments are taking place in this and associated industries and in many of the new processes centrifuging plays an increasing role. The De Laval 'Short Mix' process for continuous refining has been operating in quite a number of refineries for some years, but there has been a lack of significant information showing the advantages which can result from the use of the special hermetic centrifuges employed in this process. This has now been remedied, however, and Braae,[58, 59] in a comprehensive article, gives a very interesting account of the details of the process, together with commercial operating data from a number of different countries. Without doubt the hermetic type of centrifuge employed has a number of attractive features and advantages for this duty, compared with the conventional open or paring disc discharge type of machine. A further report on the same process has been published[60] and a similar De Laval system has been developed to meet the needs of the American vegetable oil industry for caustic or soda ash refining;[61] not only is the initial oil/soapstock separation carried out using a hermetic separator, but degumming and water washing operations also utilise this type of machine. A truly total hermetic system is thus possible, and this should fulfil a much-needed requirement of this industry, particularly in view of potential developments of refining in the miscella state and the use of ammonia for neutralisation. It is also interesting to note that a complete pilot plant work-



[*Sharples Centrifuges Ltd.*

The Sharples Super-D-Hydrator, of British manufacture, is suitable for separating, washing and dehydrating all types of crystal slurries. The machine is a perforated basket type, completely automatic, and available in a variety of constructions for different duties. The illustration shows the open type which is fitted with a control relay for regulating the operating cycle.

ing on this system is available for treating customers' samples.

The Sharples 'Low Loss' process is also a new development in this industry; it has been designed to meet the needs of medium-size refineries in which the more complicated soda ash system would not be justified. Provision is made for 'gum conditioning' with a special reagent; the gums are not separated as such, but are removed with the soapstock which is formed without using excess of lye. The oil is subsequently re-refined and double water-washed in the normal manner.[62]

In a general survey of refining methods,[63] brief reference is made to the use of centrifuges for caustic soda, soda ash, and miscella state refining, and a further article also makes reference to the last two methods.[64] Refining in the miscella state is particularly dealt with, and an example based on Stokes law shows that soapstock should settle out 15 times faster from miscella than from the ordinary crude oil under the conditions in the example; in practice, however, it is stated that centrifuging only gives a rate 1½ times as fast.

Three further articles (in German) contain useful information on the application of various types of centrifuges for the clarification of crude oil,[65] soapstock separation, soapstock deoiling, fatty acid separation and woolgrease recovery,[66] and the production of olive oil by continuous methods.[67] A further process under development makes use of a basket-type machine for separating protein liquor from sludge in the preparation of cheese from cottonseed.[68]

Patents cover several developments in this field and, as might be expected, it is continuous refining processes using centrifuges which have received most attention. These include: a two-stage process using strong lye in proportions less than theoretical followed by treatment at higher temperature with more lye in the second stage;[69–72] a process using strong lye at low temperature followed by water addition and heating;[73] a similar process followed by addition of soda ash instead of water and a subsequent treatment with more lye;[74] a further process using more specific lye concentrations in stoichiometric proportions under turbulent flow with a limit on the contact time;[75, 76] and a method of refining in the presence of an aliphatic polycarboxilic acid.[77] Another patent covers a method for recovering oil by acid cracking an emulsion obtained by treating oil-containing material with ammonium compounds or an ethanolamine;[78] methods for dewaxing rice oil,[79, 80] rice bran oil,[81] and recovering germ oil from distillery slop.[82] Equipment patented includes a special centrifuge for continuous refining,[83] mixers prior to centrifuging[84, 85] and a centrifugal process for fractionation by liquid-liquid extraction.[86]

Fish and fish-liver oils

An interesting report has been published giving data obtained using conical centrifuges instead of basket machines for the recovery of oil and the separation of solids and glue water in whale processing,[87] and for similar work in the reduction of herrings a continuous three-way centrifuge of the nozzle-type is employed.[88]

Patents covering centrifugal fish processes include oil recovery from the acid treatment of glue water from whale meat,[89] a two-stage treatment, first to separate liquid and solid and subsequent oil recovery from the liquor so obtained[90] and electrolysing ground material in salt solution, followed by filtering and centrifuging to recover the oil.[91]

New processes for the treatment of fish livers have also been developed; one such process employs a three-way nozzle separator treating a disintegrated liver/water mixture in which some of the sludge is recycled to minimise water consumption.[92] A similar process utilises a mild alkali treatment[93] and another resorts to coagulation, followed by emulsification and centrifugation.[94] Further articles refer to the use of centrifuges for removing stearine from shark-liver oil[95] and a process involving freezing, followed by mincing and thawing in water and subsequent centrifuging to recover the oil.[96]

Animal fats

Some further information on the Chayen process for animal fats has been published; the most detailed account[97] describes how the process was developed, with specific reference to the recovery of products resulting from the impulse rendering of bone. In all, five different types of centrifuge are employed, some of which were specially developed for the process. A basket machine is used for removing the bulk of fine solid from the cold effluent containing the fat, after which the majority of the fat is removed by gravity settling. A second specially constructed high-speed basket machine, developing a centrifugal force

of 4,500 times gravity, recovers a high proportion of the fat remaining in this effluent. A third basket machine is employed for removing very fine solid matter and the majority of the water from the fat recovered in the process; the fat from this machine is given a final polish in a disc-type centrifuge. Additional fat from the hot effluent produced in the process is recovered using a nozzle-type machine, and this joins the bulk of the fat for treatment in the third basket machine.

The feasibility of the process undoubtedly depends, to a large extent, on the use of centrifuges for recovering and separating the various products and it is quite likely that, as further developments arise, specialised centrifuges will be designed to meet the more exacting requirements called for in the process. Other articles on the same subject have appeared,[98–101] but these are of a less detailed nature.

Another new low-temperature rendering process also employs a centrifuge to recover the fat from heated, ground, fat-containing material,[102, 103] and details of the Titan plant using a ' Superjector ' sludge separator are also available.[104]

Soap

Some study has been given to the complete saponification of soapstock from normal vegetable-oil-refining operations, so as to remove impurities by chemical action with strong caustic, to give easier acid splitting and increase the yield of fatty acids.[105] A two-stage process is employed, with centrifuges to separate the soap and the lye phases; the results are from pilot-plant work and the indications are that the treatment is successful. Whether it will be economic commercially, particularly in view of the admitted low value of the product, is a matter for conjecture.

Details concerning the operation of a low-speed skimmer type of centrifuge separating neat soap and nigre in a French soap works form the basis of a carefully prepared report.[106] The machine offers a number of advantages, but these are, to some extent, peculiar to the particular installation and would not necessarily apply in British practice. The report has been reviewed by Wigner,[107] who suggests this centrifuge may not be ideally suited for the duty and goes on to outline the basic requirements of such a machine.

An article by Day[108] gives some further details of the Sharples continuous centrifugal soap process; this is likewise reviewed by Wigner,[107] who has the impression that the article is based on the manufacturer's claims rather than on the result of actual experience with the plant in question.

A number of patented processes employing centrifuges are included in a recent book covering this industry.[109]

Sugar

The backlog of accurate performance and operating data for the specialised machines used in this industry is a decisive factor in enabling the development of new machines with even higher efficiencies, both from the operation and mechanical point of view; without doubt there is a progressive approach to this application.

Kiessling[110, 111] has given details of a new machine developed over a number of campaigns for use by the Swedish sugar industry and 250 have now been installed. Two types of drive are available: for treating refined and raw massecuite, a d.c. motor drives the basket at 1,300 r.p.m. and for low-grade massecuite an a.c. motor to give 1,470 r.p.m.; otherwise the mechanical design of the centrifuge is the same, which includes a 48-in. bottom discharge basket arranged for fully automatic operation by a number of pre-set controls. Although this high-efficiency machine may not be absolutely necessary in certain cases, the uniformity of design, together with its labour-saving devices and reduced spare parts requirement, offsets this factor to a large extent.

A report by Vian[112] describes the construction and experimental operation of an unconventional continuous machine for treating final massecuite; the basket is in the form of a perforated truncated cone housing a screen and a conical helix rotating at a slightly different speed; there is provision for two washings. High-purity molasses and poor purging are two main faults, but the simple construction and operation of the machine warrants the further investigation which is to be made.

Reference has already been made to Escher Wyss machines,[2, 3, 4] and some further information is available concerning their use in this industry. A useful comparison has been made between the results obtained with this type and an older Watson-Laidlaw machine on cane sugar under severe conditions;[113] it is concluded that the former has a number of performance disadvantages, but the mechanical advantages are considerable and, with further improvements in design, could result in its general adoption for cane factories. A description and details of capacity, power requirements and best conditions for operation have also been outlined for two type C machines at Aarberg.[114, 115] Buddeberg[116] also refers to the Escher Wyss machines and gives some details of a similar push-type single basket machine fitted with a device for relieving the tension of the sugar layer.

Other articles of interest include: a general resume by Perk,[117] covering operating conditions, drive, basket dimensions and power factor for machines in this industry; a similar article by Ruiz,[118] who goes on to give a description of the 48-in. Roberts machine; details of Western States machines at Uitvlugt;[119] a comprehensive report describing the installations in a number of beet factories in the U.S.A.;[120, 121] Broadbent machines for use in this industry;[122] some further information on basket failure and precautions to be observed;[123] preference for and performance of Roberts G8 machines in Coloso;[124] the production of aconitic acid from B cane molasses using a De Laval nozzle separator, a basket machine and a Sharples horizontal machine for final recovery[125] and the elimination of ' floc ' in finished sugar by careful centrifuging.[126]

Process patents which have appeared include: the use of a nozzle-type separator for the clarification of limed beet or cane juice followed by extraction and reseparation of the sludge;[127] a similar process returning the sludge countercurrently to the extraction plant;[128] clarification of cane juice filtrate from vacuum filters using a nozzle-type separator;[129] recovering sugar from molasses;[130] and a continuous process for crystallising sugar.[131]

Machine patents for this industry include: a series covering constructional details of the basket, bottom discharge valve and means of operation; a discharging mechanism and an improved drive;[132–135] a feeding arrangement to give uniform distribution;[136] a machine with a helically arranged series of paddles with shoes rotating at differential speed to the basket for assisting the discharge of the crystals;[137] a design of basket fitted with stripper and curb ring to discharge crystals and prevent filling the top of the basket, respectively;[138, 139] a perforated screen containing plates separated by smaller perforated baskets each containing scrolls for conveying the crystals and means for holding back crystal from liquor, together with a method of electric heating before spinning;[140–142] and an electro-mechanical device for automatically controlling basket operations.[143]

McGinnis[144] and Honig[145] devote sections of their recent books to this application.

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[Alfa-Laval Co. Ltd.

The De Laval Type PX 20900F is a new self-opening, high efficiency, disc-type separator. It is particularly suitable for the separation of fats from water and solid matter and for the purification and clarification of all types of oils and liquids containing sludges and other impurities.

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In the second part of this article, the author will review applications of centrifuging in the chemical, brewing and fermentation, petroleum and other industries, and also auxiliary apparatus for centrifuges

MECHANICAL SEALS

A Survey of Present-Day Practice—Part 2

By B. G. Williams, A.C.G.I., B.SC.(ENG.), A.M.I.MECH.E., A.M.I.CHEM.E.

In our March issue the author described the various types of mechanical seals that are available. He also discussed how and when they should be used, materials of construction, some aspects of design, and the influence of pump design on seal operation and costs. This second and concluding part of his article contains some practical advice on operation and maintenance, along with a discussion of the applications of mechanical seals and the economics of using them.

Applications

THE first questions to be answered are: (*a*) where should mechanical seals be installed; (*b*) how much do they cost; and (*c*) what is the rate of return on the investment.

Briefly the answers are:

(*a*) Mechanical seals are often fitted in pumps where no conventional packing has been found satisfactory or where inherent leakage of liquid through the packing cannot be tolerated. Also mechanical seals have been an immediate choice where leakage of seal oil into the pump has resulted in product degradation.

(*b*) Mechanical seals are not cheap. This is largely due to the cost of materials of construction which must necessarily be hard and corrosion resistant. However, after the initial outlay, maintenance of the seal is limited to replacement of the carbon inserts and O-rings and the reclamation of the seal ring and sleeve by metallisation, electric deposition, etc.

(*c*) An evaluation on the returns realised from the installation of single mechanical seals on about 150 pumps on general refinery service showed an average return of about 200% on the investment.[3]

Individual pumps showed a return varying from 60 to 300%. The cost of fitting mechanical seals and the returns to be realised will be governed by the following factors:

(i) Pump design, operating pressure and temperature. These factors will affect the cost of packing materials and maintenance as well as the cost of installing seals.

(ii) Characteristics and value of products pumped.

(iii) Cost of seal oil and circulating system.

(iv) Amount of packing leakage, the amount recoverable and the cost of recovery.

(v) Loss of product quality or losses due to off-grade products resulting from contamination by seal oil.

In general it has been found that about 60% of the total saving effected by the installation of mechanical seals results from the reduction of product losses and off-grade products, about 15% is effected by savings in seal oil and 25% from reduced maintenance costs.

Slurries

The presence of grit or dirt in the product being handled adversely affects single mechanical seals. The liquid does not have to be absolutely clean, but seal difficulties rise somewhat in proportion to the contamination by solid particles. Whilst the faces remain together, no solid particle can enter between them. If separation occurs, solid particles will pass between the faces, scoring the smooth surfaces and causing failure. As liquid passing through the scratch carries more abrasive particles, the effect is accumulative. It is almost impossible to seal the leak once it has started.

To permit seal operation under these conditions a clean flushing stream from a different source may be employed to wash the stuffing box. There is also the possibility of utilising the centrifuging action of the pump by tapping the pump casing just above the wear rings to obtain slightly cleaner liquid for washing back.

Flushing and cooling

Seal glands can be water-cooled and, when auxiliary packing is provided, vent or drain holes may be drilled in the gland. The scaling tendency of most industrial water supplies minimises its suitability as an auxiliary packing lubricant and quench. Experience has shown that scale formation may restrict seal movement and cause failure.

In the case of light hydrocarbon fractions it is usually necessary to introduce liquid into the stuffing box at some pressure greater than the suction pressure in order to prevent

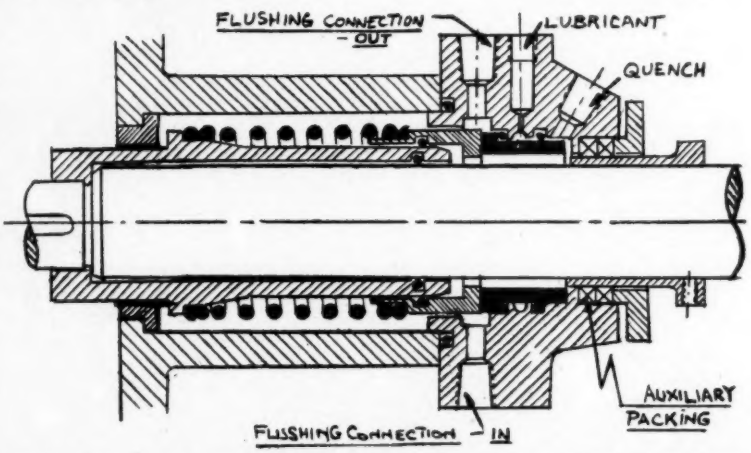
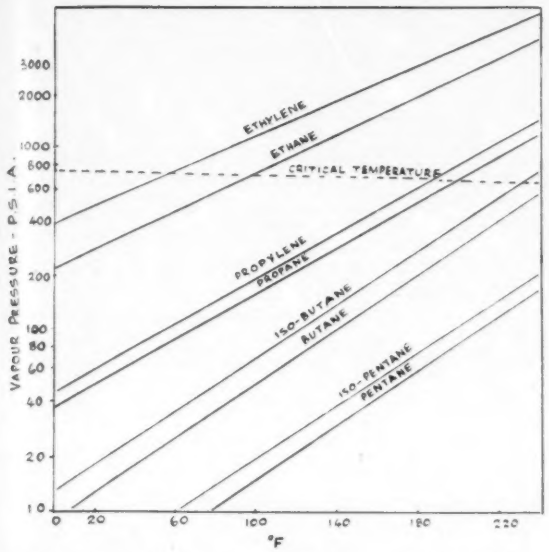


Fig. 14. Typical mechanical seal with auxiliary packing and flushing, lubricant and quench connections.



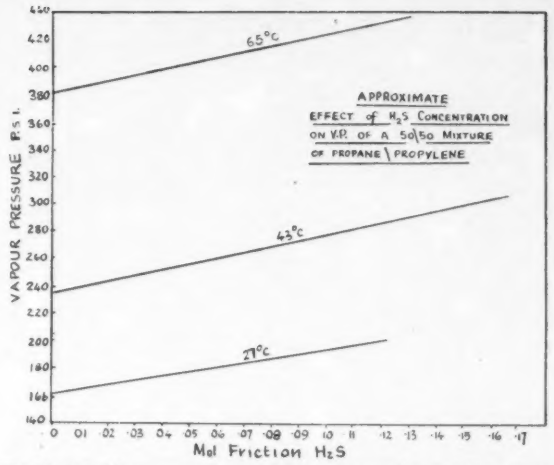


Fig. 15. *Left:* **Vapour pressure—temperature diagram for some troublesome hydrocarbons, showing critical temperature.**

Fig. 16. *Above:* **Effect of hydrogen sulphide concentration on a propane/propylene stream.**

flashing caused by the frictional heat generated. If a line from the pump discharge is piped to the stuffing box, the effect of the throat bushing, in the event of seal failure, will be cancelled unless a restriction is installed to limit flow in the new cooling line.

Flushing the stuffing box is also desirable in order to purge solids and gum-forming materials which might settle out and interfere with seal movement. On the single-stage type of pump with the packing box under suction pressure, a connection is provided from the discharge line to the stuffing-box flushing connection. This ensures a slight product recirculation for purging and cooling. In the case of single-stage pumps with the stuffing box under discharge pressure the flushing line is connected from the stuffing box to the pump suction. In all cases it is advisable to provide the flushing connections in the stuffing box as close as possible to the seal faces to ensure effective cooling.

Causes of seal failure

A minimum seal life of approximately 12 months should be the aim in all except the most severe applications. A seal life of two years is not uncommon when handling clean, cool products of a non-corrosive nature.

The life of an unbalanced seal will be appreciably reduced when operating at differential pressures in excess of 75 p.s.i. across the seal.

The primary cause in the majority of premature seal failures is overheating. This may come about through operating the pump dry when starting up and shutting down. If possible, a continuous bleed should be led from the top of the pump casing back into the vapour space of the vessel from which the material is being pumped.

A number of recommendations are given below which, if carried out, will certainly increase seal life.

(*a*) Spare pumps should be turned over once each day.

(*b*) Fluid pressure should be kept on spare pumps.

(*c*) Vent line should be open when starting up or when there is danger of the pump losing suction.

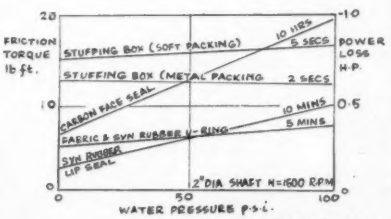
(*d*) Flushing connections must be kept open.

(*e*) Ensure gland cooling water is circulating before starting pump.

(*f*) Remove ice formation from seals by blowing steam or by running hot water over the seal boxes until the seal makes up.

(*g*) Adjustment to mechanical seals must be made by a qualified mechanical fitter.

Vibration or any out-of-balance will also cause a failure. The reason for this is immediately apparent. When a shaft is vibrating at 2,950 r.p.m., the seal must flex 2,950 times a minute. Slowness of response will result in separation of the seal faces unless a heavy spring tension is applied initially. Heavy spring loadings are to be avoided, on account of their influence on seal-face pressure and consequently on the life of the seal faces. Excessive vibration cannot be accommodated by the seal and a failure will result. As an example, one company reported repeated failure on one particular pump.[4] On investigation it was found that the pump impeller had been damaged and a small piece of metal was missing from the periphery. This was sufficient to cause out-of-balance of the rotating element, which resulted in continual failure. It must also be realised that multi-stage pumps by virtue of their inherent design will become increasingly difficult to seal successfully with mechanical seals as the number of stages increases.



[*Fluid Handling*

Fig. 17. H.p. absorbed.

The pumping system must also be closely examined for causes of seal failure. It is not uncommon to find centrifugal pumps fitted with mechanical seals boosting into reciprocating pumps. The pressure surges caused by the intermittent flow of product along the line may be sufficient to cause intermittent blowing of the seal or even total failure.

Controlling the leakage at failure is a most important problem. This becomes especially critical when the product is highly volatile such as the lighter hydrocarbon fractions.

A partial seal failure will flood the gland area with gas and any ignition point such as a hot bearing may precipitate a fire. Confinement of this leakage with improved pump housing design will minimise this danger.

The installation of a close-fitting throat bushing will give sufficient throttling to restrict the flow from the

inside of the pump in the event of a total seal failure.

Auxiliary packings[5] may be used in such cases and the glands should be fitted with connections so that the box can be vented away from the pump or snuffed with steam or water (Fig. 14).

Seal failure will also occur if the seal components are not concentric with the axis of the pump shaft. When converting pumps with stuffing boxes designed for soft packing it is essential to locate the gland plate, so that the carbon insert is concentric with the pump shaft. The gland plate is positively located in a machined recess in the stuffing-box housing and generally held with fitted bolts.

Effect of temperature, pressure and dissolved gases

The pressure in the stuffing box must be higher by a comparatively safe margin than the product being pumped. The effect of temperature is to bring about a rise in vapour pressure. Consequently, if the fluid pressure is only slightly above the vapour pressure of the product, the film of liquid between the mechanical seal faces may suddenly vaporise and expand due to the frictional heat generated.

The adiabatic expansion of the gas will cause refrigeration in vicinity of the seal faces, producing ice formation. The hard ice crystals will further score the smooth seal faces, making reseating of the faces impossible until the ice is removed by a steam lance.

Generally it is wise to maintain a stuffing-box pressure at least 25 p.s.i. above the vapour pressure of the product at the operating temperature conditions. The higher the stuffing-box pressure the better will be the performance of the mechanical seal. When restricting the flow through the bypass connection, care must be taken to prevent the installation of so small an orifice that the resulting pressure drop produces a low pressure in the stuffing box. A pressure gauge connection fitted between the restriction and the gland plate will allow the pressure to be checked.

A vapour pressure-temperature chart is given in Fig. 15 for the more common troublesome hydrocarbons. The critical temperature—the temperature above which no amount of increased pressure will produce liquefaction—is also given. For any particular fraction, operating close to the critical temperature conditions will inevitably produce mechanical seal difficulties.

The effect of dissolved gases is to increase the vapour pressure. The most common dissolved gas met in the refinery in light hydrocarbon streams is hydrogen sulphide. When the seals start to blow on pumps on these duties, the hydrogen sulphide content must be immediately checked. The playing of steam lances on the blowing seal whilst the operators reduce the hydrogen sulphide content of the stream will usually allow the seal to reseat satisfactorily.

The effect of hydrogen sulphide concentration on a propane/propylene stream is given in Fig. 16.

In order to minimise the number of spare components kept in stock to maintain mechanical seals, it is a sound policy for the larger user to standardise on a given series of mechanical seals. The type of seal chosen should preferably be of the partially balanced type, robust and designed in such a manner that worn parts can be recovered by metal spraying and carbon inserts readily replaced. O-rings should be stocked in sets, as it is normal practice to renew all O-rings when re-assembling the seal.

Preventive maintenance

As users become more familiar with mechanical seals, records can be built up giving average running hours before component replacement is necessary. Premature failure provides the opportunity for spot checking, but it is not uncommon for a mechanical seal to give such trouble-free service that the seal ring cuts completely through the carbon insert and supporting O-ring and makes a joint on the gland plate. Not only is this failure extremely dangerous, due to the possibility of producing sparks by the metal-to-metal contact, but unnecessary damage is suffered by the gland plate which could have been prevented by routine replacement conducted from past records. This type of failure is usually recognised by the fact that the seal only leaks when the pump is standing.

Often it is of importance to confirm that a seal can be used to handle a particularly awkward fluid. Operators are usually hesitant to experiment on process pumps, because of their relationship to production as a whole. It is comparatively inexpensive to build a testing device that will permit the circulation of the fluid being pumped at process temperatures and pressures through a dummy pot or portable pump operating at process pump speed with the proposed mechanical seal to determine the suitability of the design and materials of construction.

Power absorbed

Experiments[1] have shown that the horsepower absorbed by mechanical seals is high and may exceed that of the soft packing type of seal at high pressures. The coefficient of friction is independent of the speed of rotation (at normal pump operational speeds), so that the power loss is proportional to the thrust on the seal face. Fig. 17 provides a means for comparison of the various types of rotary seal tested under similar conditions.

When comparing the h.p. absorbed by the various types of seals and packings, the advantages of the mechanical seal (low leakage, low maintenance costs, etc.) must not be overlooked.

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Temperature control unit

A new unit (Type N. 856) has been developed for controlling the temperature of platens, ovens, rooms, containers, liquids, gases, etc., in the very wide range –96 to 428°C.

It normally utilises a flat mica-resistance-type, sensitive element which is mounted in close proximity to the medium to be controlled, but for immersion in liquids, use in corrosive or damp atmospheres, or for controlling temperatures above 300°C., a sealed platinum bulb thermometer may be employed as the temperature-sensitive element.

The element forms one arm of a bridge circuit, another arm of which is made variable to provide the adjustment of temperature. The bridge out-of-balance voltage is amplified and used to operate two separate relays at slightly different temperatures, the temperature difference being adjustable between 0 and about 3°C.

This arrangement enables the three conditions, 'temperature low,' 'temperature correct' and 'temperature high,' to be detected, and the unit can therefore be used to control not only electrically heated elements but also heating or cooling processes using motor-controlled valves, etc.

The sensitivity of the equipment is stated to be such that the relays operate and release on changes of the control resistance of 0.1%. This represents a temperature change of 0.25°C. for the mica-resistance element and 0.4°C. for the platinum bulb thermometer at 100°C.

Airmec Ltd. are the makers.

Pre-View of the Achema XI

★ Chemical Plant
★ Materials · Instruments
★ Laboratory Apparatus
★ Plastics Machinery, etc.

Exhibition and Congress

From May 14 to 22, the European Convention of Chemical Engineering will be held at Frankfurt-am-Main, Germany. This includes, among other functions, the Congress of the European Federation of Chemical Engineering and the Achema XI Exhibition and Congress, organised by Dechema (Deutsche Gesellschaft für chemisches Apparatewesen)—the German association of chemical plant manufacturers. These events show promise of surpassing previous occasions—at the Achema, for instance, the number of stands will be increased by about half—and of shedding some interesting light on recent achievements in the realm of chemical engineering. The illustrated pre-view of the Achema XI which appears in this special issue of CHEMICAL & PROCESS ENGINEERING *is designed to serve not only as a handy guide to the exhibition, but also as a key to these achievements. For the reader's further enlightenment, it is preceded by an article in which a German authority puts a shrewd finger on some of the chemical engineering trends that will be evident at the Achema. Let us, then, turn back the cover to gain a pre-view of this most interesting event . . .*

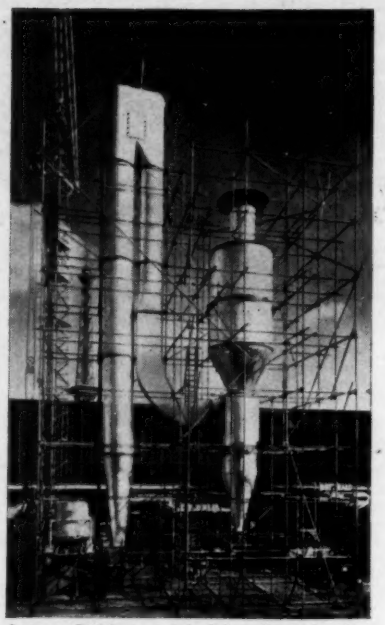
New Trends in Plant Design at the Achema XI

AT intervals of two or three years an exhibition has been held in Frankfurt-am-Main, Germany, at which has been presented everything that is needed for the equipment of chemical plants of all kinds. It is called the Achema—Ausstellung für chemisches Apparatewesen (Exhibition of Chemical Apparatus).

The Achema XI, the subject of this special preview in CHEMICAL & PROCESS ENGINEERING, will be held from May 14 to 22, 1955. While the Achema X in 1952 had about 550 exhibitors, by the beginning of this year more than 750 stands had already been hired for the Achema XI and, allowing for the fact that bookings during the last month or so are unknown, the increase should be about 50%. The area of the Frankfurt Fair, about 210,000 sq. m., will be wholly taken up. About 10% of the exhibiting firms are non-German.

A distinguishing feature of the Achema is that it is the chemists, physicists and engineers who prevail on the stands, not the salesmen. The principal object is not to sell machines or instruments, but to have discussions with engineers and scientists on vital problems. At the same time as the Achema there is held in Frankfurt, in the same grounds, the Congress of the European Federation of Chemical Engineering. Thus the exhibition provides points for discussion during the Congress, while, on the other hand, points raised during the lectures and discussions can be raised with manufacturers on the stands afterwards. It is this feature which has contributed most to the success of these exhibitions. The visitors were always highly impressed and the firms exhibiting were very satisfied; even if they had not filled their order books, they had won many new connections with industrialists from Germany and from abroad. At the Achema X the number of foreign visitors was some 3,000; 200% more than at the Achema IX.

This great interest undoubtedly owes much to the reputation of the chemical industry in Germany, and likewise of chemical engineering which has always been in close association in order to build the plants for high pressure, high vacuum and abnormal conditions which have brought success to the chemical industry. Chemical engineering has been trained by the severe conditions imposed on materials and instruments in chemical plants to a very high skill.



Large Bühler quick-drier for plastics drying (Karl Fischer).

There are four main groups at the Achema: machines and apparatus; instruments and devices for measuring and regulating; laboratory instruments and apparatus; and, last but not least, materials. It is possible to find several firms catering for everything a manufacturer of chemicals, pharmaceutical products, foods, etc., may require. In addition there are the big firms which supervise the building of complete plants, such as the Lurgi concern at Frankfurt, who will be showing interesting details of some processes applied at the big Sasol oil-and-chemicals-from-coal project in South Africa. Naturally this can only be done in a somewhat modest way by means of drawings, photographs, etc. It is interesting to note in this connection that an American firm, Scientific Design Co. Inc., New York, who design chemical processes and plant, will also be in Frankfurt. They will show a modern technique for direct oxidation of ethylene oxide, giving highest yields and higher quality than the chlorhydrin process at lower investments.

Let us now review a few of the interesting developments that will be presented at the Achema XI in the light of recent progress in the various technologies and under the broad classifications of (*a*) materials, (*b*) machinery and (*c*) instruments and laboratory apparatus.

(a) Materials

Chemical engineering was in the beginning mainly concerned with problems of operating conditions and their influence on materials. It would seem almost that all problems of this kind have been solved. All kinds of metals are used for plant and apparatus; they are clad with other metals and these are welded as well as all kinds of non-corrosive steels. Metal chimneys of 150 to 240 ft. in height can be built, needing no foundations but only a light structure for support. Metals can be protected with all sorts of coatings.

Enamelling techniques have been extended and some interesting developments in the field of glass-lined equipment will be shown at the Achema. A recently developed glass enamelling material with very high alkali and acid resistance will claim a good deal of attention. Pfaudler Werke A.G., closely connected with the Enamelled Metal Products Corp., of London, will show glass-lined tubular heat exchangers and absorption columns. These are a striking example of standardisation, since they can be assembled, in any one of five different diameters, to achieve any required height.

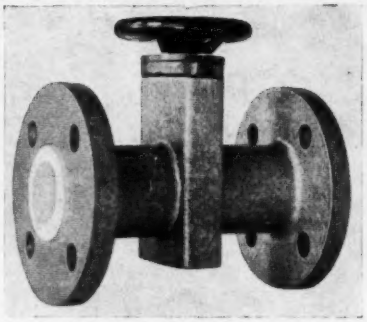
In the field of glass-lined apparatus, the French firm of Danto-Rogeat & Cie will also have some new developments to report. In some applications, the replacement of precious metals by vitreous enamel is possible, while the most recent developments include enamels resistant to thermal shock.

A most interesting feature is the rapidly growing use of plastics in the chemical industry. The Achema strictly confines plastics exhibits to the use of these materials for the chemical industry, since the more general uses are publicised elsewhere. Large items of plant, and equipment such as acid pumps, can now be made wholly of plastics. From one exhibition to another the dimensions of these constructions are rapidly growing. Pipelines made of plastics will be of

As a prelude to our illustrated pre-view of the Achema XI, an on-the-spot German observer gives a commentary on this event in relation to current chemical engineering trends. Out of the wealth of new developments in plant, apparatus, instruments and materials he draws one or two typical examples and discusses their significance. The growing influence of plastics in chemical plant design, and the changes wrought by the need for continuous processes are among topics he discusses, after summarising briefly the nature and scope of the Achema.

special interest to the chemical industry. Leading firms of the iron industry in the Ruhr have already proved their interest in pipes of plastics by forming new companies to engage in their manufacture. The good prospects which plastics enjoy for the near future are demonstrated by this fact, and it will be interesting to study the possibilities shining up in the exhibits of the Achema XI.

An interesting development involving the use of plastics is a new valve with a completely straight passage achieved by the application of an interchangeable sleeve of plastics. The composition can be chosen to suit the medium which is to be used. The well-known principle of the pinch-cock used in chemical laboratories is applied on an industrial scale. Schönebecker Brunnenfilter GmbH. make these new valves in light alloys for working pressure up to 142 p.s.i., and in cast iron for higher temperatures and pressures. The special advantage of the new valve is its completely circular straight bore without diminishing the diameter, thus eliminating problems of sediment, etc.



Schönebecker Brunnenfilter supply this gate valve, incorporating a free straight passage, for use in the chemical, food and other industries.

(b) Machinery

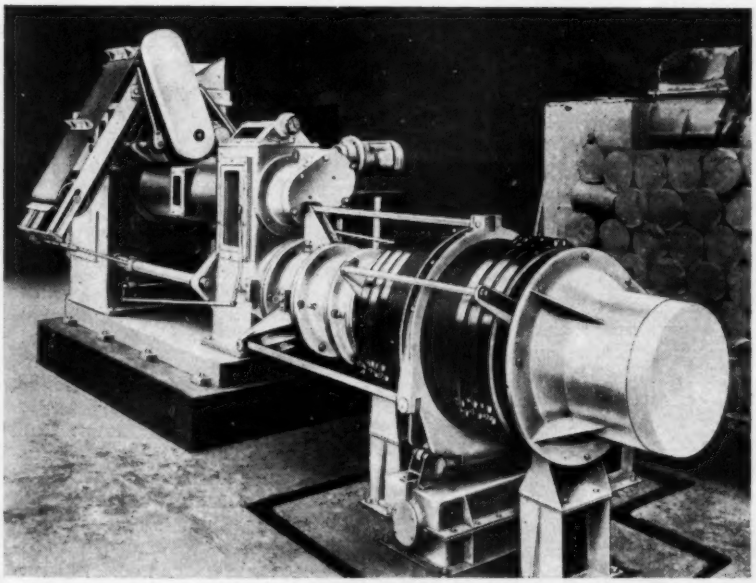
Naturally the increasing manufacture of articles made of plastics is also an influence on the manufacture of machinery. For instance, the pulverisation of materials affected by rising temperature such as softened polyvinyl chloride cannot be effected in the conventional type of mill. A new type of mill which has been designed by Alpine A.G. is stated to solve such problems.

A problem presents itself in the drying of wet powders of plastics coming from the centrifuge with a humidity content of about 20%, since there is a tendency for decomposition and other troubles to occur. To obviate this, Karl Fischer have developed a pneumatic drier in which the material is dried while suspended in air in a few seconds without coming to higher temperatures.

Many European manufacturers of plastics moulding machinery formerly exhibited in Frankfurt, but most of them have changed over to other exhibitions, so that only a few will be represented at the Achema XI.

There is no doubt about the growing interest in hardening the surfaces of plastics by coating them with metals or oxides of them. In one process that has been developed, the coating material is heated under high vacuum (10^{-4} to 10^{-5} mm. Hg) to vaporising temperature. It condenses on all surfaces which can be reached rectilineally and gives a high gloss, if the base is glossy. The layers are so thin that only about 1 cc. is required for 10,000 sq. cm. of coated surface. (E. Leybold's Nachfolger.)

Ceramics are an important feature at the Achema. One of the reasons why they are able to stand the competition of metals and plastics is that the machinery used in ceramic plants has been brought to a very high degree of perfection. For instance, an interesting vacuum press for the de-aeration of china clay for insulators is marketed by the firm of Soest-Ferrum. Air is expelled by the kneading elements, then the prepressed clay is disintegrated again and de-aerated in a vacuum chamber from which it falls to a worm press.



This 'swinging grid' vacuum press, embodying novel features, is marketed by Soest-Ferrum.

(c) Instruments and laboratory equipment

The most interesting trend in the chemical industry is the change from batch to continuous processes. In big chemical plants full 'automation' has been achieved years before it was tried in the manufacture of automobiles. But continuous registration of *p*H has been accomplished only in recent years. Hartmann & Braun will show some interesting devices for use in this field. The number of variables to be observed and registered has become so great that the chemical industry is anxious to have instruments

(*Concluded on page* 145)

Pre-View of the Exhibition

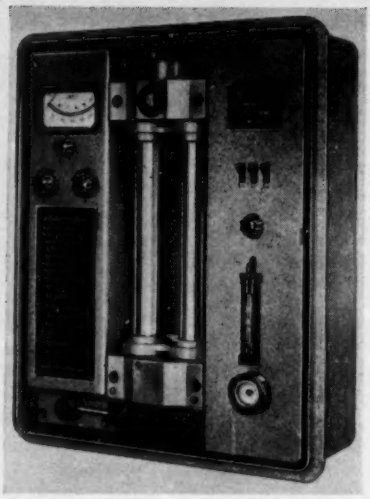
Hall I

Laboratory equipment, apparatus, machines and auxiliaries. Technical instruments for measurement and control.

Siemens & Halske A.G., Karlsruhe, will exhibit a number of new forms of **measuring instruments and apparatus.** These include thermocouples and resistance thermometers for high-pressure plant; meters for corrosive liquids, such as hydrochloric acid and other substances containing chlorine; electropneumatic apparatus for proportioning the flow of liquids and gases; electric apparatus for the measurement and control of low-pressure gas streams, for example in blast furnaces; air humidity indicating, recording and regulating apparatus; and fully automatic space-heating and air-conditioning control appliances. (Stand A. 1—3.)

Quarzlampen GmbH., Hanau. The company are exhibiting **water sterilisation equipment** using intense ultra-violet radiation; a novel analysis lamp in which 254-μ radiations are used and which is stated to be particularly suitable for paper chromatography; and equipment, including a Xenon high-pressure radiator, for testing colour fastness. (A. 4.)

Strohlein & Co., Dusseldorf. **Chemical apparatus.** An interesting apparatus that will be seen on this stand is for combined carbon and sulphur determination in iron and steel by the Holthaus-Seuthe system. One of the advantages claimed for this system is the considerable saving of time, as both carbon and sulphur content can be determined with only one weighing in about 4 min. The essence of the process is that, if steel or iron chips are burnt in oxygen at about 1,200°, the carbon in the test sample is converted into carbonic acid, while the sulphur forms in part sulphuric dioxide and in part sulphuric anhydride. If this gas mixture is passed through an absorption vessel filled with a hydrogen peroxide solution, the whole of the sulphur is retained as sulphuric acid. The gas liberated from the sulphur can then be measured in a burette and freed of its carbonic acid content by introducing it into an absorption vessel filled with a caustic potash solution. The difference in volume arising in the burette then indicates directly the percentage of carbon. The absorbed sulphuric acid will be titrated with volumetric caustic soda solution. For determining the final point, either a colour indicator or the potentiometric procedure may be employed. The titrating burette will immediately indicate % S.



The 'Uras' infra-red absorption recorder will be displayed by Hartmann & Braun.

The apparatus used is a combination of the company's rapid volumetric apparatus for the determination of carbon and that for the determination of sulphur. These items will also be shown. A further apparatus that will appear on this stand is for coulometric titration with micro carbon and sulphur determinator, according to the electrolytic-potentiometric process. (A. 7.)

Georg C. K. Withof GmbH., Kassel-Hasenhecke. **Thermoelectric apparatus.** A range of instruments for measuring, recording and controlling temperature will be on view. These include various types of continuous-temperature chart recorders giving readings from one or more different points; thermocouples and resistance thermometers; thermostats; dial thermometers; portable electric temperature indicators; rectifiers for the operation of measuring and controlling installations; remote-indicating and controlling devices for temperature, pressure and liquid level in containers. (A. 12.)

Jena^{er} Glaswerk Schott & Gen, Mainz. **Special glasses** for scientific and technical purposes. Some interesting examples of this company's very varied range of products from its glassworks will be shown. These will include coloured optical glasses and interference filters (narrow-band filters, cut-off filters and heat filters). There will also be glass electrodes for the electrometric determination of *p*H values, specially constructed for very severe working conditions; the Ubbelohde suspended level viscosimeter; and a recently developed heat-saving, double, water distillation apparatus, in which the revaporisation of the primary distillate takes place under a vacuum produced by a waterjet pump placed in series in front of the condenser. A further exhibit will be combined oil-diffusion and steam-jet pumps made of resistant glass for the production of high vacuum. Finally, there will be flash distillation apparatus of the Utzinger type. (C. 6.)

Hilger & Watts Ltd., London. **Spectrographs, spectrophotometers,** etc. This company's display will include a direct-reading attachment to the medium quartz spectrograph, E. 750. This combination forms a direct-reading spectrometer suitable for analyses of up to 11 elements in most non-ferrous alloys. Successful analyses have been made of alloys having as base metal aluminium, magnesium and copper, and it has been used with success for the estimation of additives in oil (calcium, barium, phosphorus and zinc). Less than 3 min. is commonly needed for an analysis of 10 elements.

Other exhibits on this stand will include a metal ratio analyser, a recording infra-red spectrophotometer, the Uvispek photoelectric spectrophotometer, a photoelectric absorptiometer and fluorimeter, the Hilger outfit for Raman spectrography, a fluorite vacuum spectrograph, a photoelectric Tristimulus colorimeter and a microptic polarimeter. (F. 13, G. 13.)

Ernst Leitz GmbH., Wetzlar, are exhibiting **optical instruments** for use in the chemical industry. Their range includes an infra-red spectrograph with fully automatic or semi-automatic registration. It can be used, even by untrained staff, for measuring absorption curves in the range of 1 to 15μ with a sodium chloride prism and in the range of 10 to 24μ with a potassium bromide prism.

The instrument uses the double-path beam method. One light beam passes through the specimen to be analysed, while the other passes through a diaphragm with adjustable and measurable aperture. The split-

In this section we take the reader on a tour through the various exhibition halls at Frankfurt and point out some of the highlights. Like any other visitor, we find that it is not possible to visit all the stands; nor, at those we do visit, can we stop to examine every exhibit. However, we have tried to give a representative picture of the exhibition and at the same time to give prominence to the more interesting developments. For this we have been dependent on the help of exhibitors and if we have achieved our object it will be due in a very large measure to their ready co-operation.

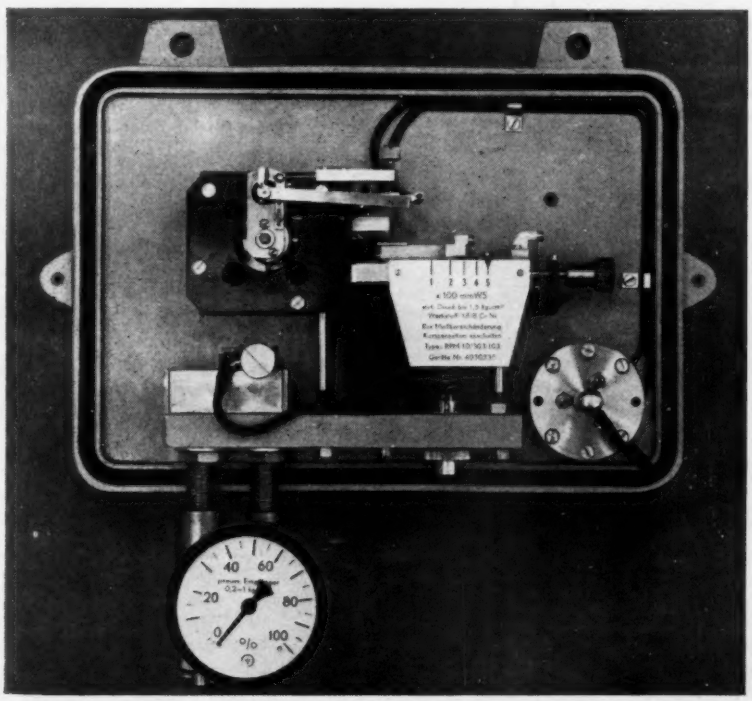
We have grouped the exhibits under the various halls in which they will appear, and in alphabetical order of the stands. This arrangement serves the dual purpose of dividing the exhibits into rough classifications and providing a handy guide to the exhibition.

ting up of the original light beam is done by a mirror rotating at 750 r.p.m. The separated beams are directed towards the same thermocouple instrument. In this way the transmission value is obtained immediately without any calculation.

The instrument enables the organic chemist to answer questions concerning constitution, to follow polymerisation processes and to carry out qualitative and quantitative analyses even in cases such as mixtures of isomers, where purely chemical methods are impossible or difficult.

Other instruments to be displayed by Leitz include photometers for visual and photoelectric measurement, monochromators, hand spectroscopes, micro refractometers, dilatometers and special microcopes for chemists, which allow the observation of precipitations and crystallisations in beakers, conical flasks and test tubes at temperatures between −20 and +350°C. The inorganic chemist will be particularly interested in a microscope built for temperatures up to 1,600°C. (H. 6.)

Hartmann & Braun A.G., Frankfurt-am-Main. **Electrical and process control instruments.** The company are exhibiting a number of devices for the continuous measurement of *p*H values by means of antimony and glass electrode chains which can be used under conditions of up to 6-atm. pressure and 100°C. The elements can be connected to indicating, recording and controlling devices. The company are also showing apparatus for the continuous measurement of gas concentration. The 'Magnos' oxygen meters are constructed to deal with ranges of concentrations of from 0 to 1, 0 to 100 or 90 to 100% by volume of oxygen. The action depends on a purely physical process and they can be used for the purposes of continuous measurement, recording or control. Another interesting exhibit is the *Uras* infra-red absorption recorder. All gases which have the property of absorbing certain specific bands in the infra-red range can be estimated by means of this apparatus which, it is stated, is particularly suitable for use with CO_2, CO and CH_4. (H. 7.)



J. C. Eckardt A.G. are displaying this differential pressure converter (cover removed).

Carl Zeiss, Oberkochen. **Optical and measuring equipment, microscopes,** etc. In addition to a new type of the Abbé refractometer and a projecting refractometer, a photoelectric recording instrument has been designed and this is known as the *Refractograph*. A new fire-damp interferometer has been developed which enables the methane concentration to be accurately determined by direct reading on the spot.

New types of microscopes will also be included in this display. (H. 8.)

Zeiss Ikon A.G. Goerzwerk, Berlin, are manufacturers of **colorimeters** and show a chlorometer which, it is stated, allows a quick and accurate determination of chlorine and hypochlorites in water. The o-tolidine method has been improved by the use of a new compensation colorimeter and

the U.S.A. standard method. All types of water can be easily compared with the tolidine water mixture in spite of different alkalinity, clarity and colour. The scale is divided into 50 divisions and numbered from 0.01 to 0.50, the numbers representing mg./l. of chlorine. For the determination of chlorine in swimming-pool water or industrial-waste waters with a higher chlorine content than 0.5 mg./l., the specimen is diluted with distilled water or a smaller cup is used in the apparatus. The cups are made of plastics material. Testing can be carried out on the spot by untrained personnel.

The calibration is done by electrometric titration with sodium thiosulphate according to a new method which has been developed recently in the Gas Institute of the Technical University of Karlsruhe. (H. 8.)

J. C. Eckardt A.G., Stuttgart-Bad Cannstatt. **Thermostatic and thermographic control** systems. Piston meters employing the volumetric principle of flow measurement will be exhibited by this firm. These meters are suitable for liquids with a viscosity of up to about 25° Engler and temperatures up to 170°C. The regulator can be adjusted for proportional, proportional-differential, proportional-integral, proportional-integral-differential, integral and integral-differential readings. Compressed air with a minimum of 2½ and a maximum of 6 kg./sq.cm. pressure is required for operation. This regulating system can be used in petroleum refineries and chemical plants.

The pneumatic differential pressure converter is for the measurement and regulation of the flow of substances which, on account of their properties, must be kept away from the metering mechanism. The device operates like a mechanical balance on the zero method. The regulating power generated by the effective head is compensated by an equal pneumatic counter-force. The air pressure required for this purpose represents the effective-head value and this measures the flow volume. A head meter in the flow channel transmits the flow-volume reading on the effective-head principle producing within the effective-head range of the appliance proportional transmission pressures of between 0.2 and 1 kg./sq.cm., which actuate the pressure system of the flow meter or regulator. The measuring device and the power amplifier of the transducer are pneumatically coupled with the compressed-air jet. The forces generated by the effective head and by the compensation system are in equilibrium over the entire working range of the appliance. It is stated that pressure or temperature fluctuations of the flow do not affect the transmission ratio of the converter.

Fuchs-Letschert Sohn will demonstrate the efficiency of the 'Pallring' packing body, developed by the Badische Anilin & Soda-Fabrik A.G.

Unlike the mercury-float meter, the differential-pressure converter with terminal metering system is a dry system. The appliance is installed close to the effective-head generator. This arrangement is claimed to have the following advantages:

(*a*) Elimination of the usual pressure pipes to the flow meter or regulator, carrying corrosive, inflammable, explosive or highly viscous liquids. The effective head is pneumatically reproduced by the converter and is transmitted by an air pipe.

(*b*) Installation of separators between head meter and metering system is unnecessary. (H. 12.)

Hall Ia

Constructional materials for chemical technology—metallic and non-metallic—as well as industrial plant and equipment made from these materials.

Fuchs-Letschert Sohn, Baumbach, manufacturers of **ceramic tower packings.** This firm's display will centre on the *Pallring* developed by the Badische Anilin- & Soda-Fabrik A.G., Ludwigshafen. This packing body derives from a normal cylinder, the wall of which is opened in such a manner that laps are stamped out and bent inwards. A feature to be noted is that the interior projections are so far from the cylinder ends that they cannot be touched by the neighbouring ring. The *Pallring* is available in ceramic material or metal at present; manufacture of carbonaceous rings is scheduled to take place in the near future. It is stated that the 50-mm. *Pallring* has the efficiency of a 25-mm. normal ring, with one-tenth of the latter's resistance. The special domain of the *Pallring* is in vacuum distillation.

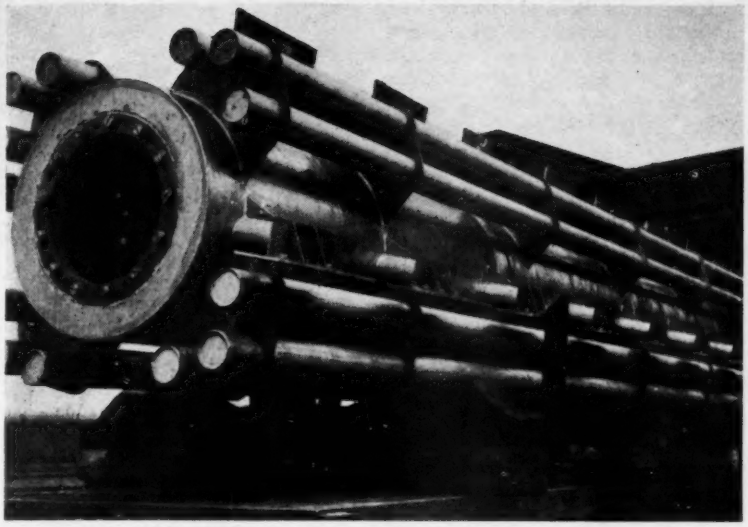
At their stand at the Achema XI, Fuchs-Letschert propose to demonstrate the difference *in vitro* as well as *in vivo* between two columns, one of which will be packed with *Pallrings* and the other with plain rings. (A.40.)

Rheinische Röhrenwerke A.G., Muelheim/Ruhr. **Steel tubes and plate, special steels.** The production programme of this company includes the manufacture of tubing from the usual low-alloy, heat-resisting Cr-Mo steels, such as are used in the construction of steam boilers, and also from heat-resisting *Sicromal* and *Rheinrohr* range of steels which are claimed to have excellent non-scaling properties. The company reports that the latest development in the drive towards still higher temperatures has been the introduction of the high heat-resisting austenitic Cr-Ni steel, types *Rheinrohr* 18/12 S, 18/12 MS and 18/12 MVS. These special steels have a wide range of applications in various branches of industry and engineering as well as in boiler construction.

The synthesis of ammonia and cracking processes for petroleum require steels which will withstand high hydrogen pressures. A range of special steels is being produced for such purposes which contain from 1 to 18% of chromium in addition to other alloy-forming elements.

This company will also present heat- and acid-resistant steels with a high chromium content of not less than 12%; a range of cold-resisting steels for refrigeration techniques; clad steels and also special steels to take surface coatings.

The introduction of aluminium alloy *Sicromal* steels was attended by certain initial difficulties, because these materials are difficult to weld. This problem has now been solved by the development of special welding materials. A further branch of the company's activities is represented by the use of a number of modern welding processes for the construction of



Vacuum drier fabricated from Cr-Ni-clad steel (Rheinische Roerenwerke A.G.)

large and often complicated items of plant and special equipment from their range of steels. (D. 6—11, E. 6—11.)

Dr. Schliebs & Co., Baumbach. **Packings, fixtures for towers and columns.** This company will exhibit their conical distribution plate—a fixture which is aimed at solving the problem created by the tendency of the liquid in packed towers and columns to stream outwards and flow down the wall and thus avoid contact with the ascending vapour. The distributor plate, developed by Prof. E. Kirschbaum, is provided with holes of which the wider ones serve as passages for the vapour while the narrow ones allow passage for the liquid. On reaching the wall, liquid is led back into the interior zones of the packing. The distributor plate is made in acid-resisting stoneware, steel, cast iron, copper, aluminium, stainless steel and other materials.

Another exhibit will be the Braun grid support for use with various packing bodies. (A. 49.)

Aug. Schnakenberg & Co., Bleibearbeitung GmbH., Wuppertal. Manufacturers of **chemical plant in lead.** The company proposes to exhibit items representing the important position of lead as a constructional material for the chemical industry. (M. 1—2, N. 1—2.)

Bergische Stahl-Industrie, Remscheid. **Corrosion-resistant steel castings and fittings.** This company has developed a ferritic, chromium, cast-steel alloy by an admixture of nickel, which is claimed to impart high strength and abrasion resistance to even the biggest casts as well as corrosion resistance. The austenitic Cr-Ni cast steel is also made highly resistant to sulphuric acid and its salts, it is claimed, owing to the copper content in addition to an admixture of molybdenum. The alloy has been marketed as *Corrodur* 20.25 E. In addition, the company supply a nickel-molybdenum alloy, *Bergit*. Other activities of this company include the production of headers, return bends and fittings from Cr-Mo cast steel for oil refineries and chemical processing plants. (O. 3—5, P. 3—5.)

Deutsche Steinzeugwarenfabrik, Mannheim-Friedrichsfeld, display machines and equipment made of **acid-resistant stoneware.** There are also new special compounds which have greater resistance to mechanical stress and abrasion and higher heat conductivity, which confers an increased resistance to thermal shock. A special compound is also available for use under conditions of abrupt changes in temperature in cases where resistance to chemicals is of secondary importance.

In most cases, plant can now be finished by precision grinding, and internal and external screw threads can be cut in stoneware as easily as in metal. This process is used in the manufacture of glands, suction bushings and balls for valves. Rollers made of stoneware with polished faces (tolerance within 0.01 mm.) are made for the textile, chemical, cosmetic and pharmaceutical industries.

In addition to the self-priming, two-stage, rotary pump SRD, made of stoneware, the 'Hannibal' pump is being manufactured in stoneware and will soon be available in two sizes. This pump is self-priming by virtue of an injector nozzle which creates a vacuum and applies suction to the liquid to be transferred when the pump is started, after which it functions as an ordinary centrifugal pump. The 'Hannibal' pump has the great advantage that it can be used for liquids which are dirty, contaminated or which contain fibrous material. The designed capacities are 80 and 40 cu.m./hr. with a delivery head of between 15 and 20 m. at 1,450 r.p.m. (O. 6—8, P. 6—8.)

Siemens-Plania. Chemische Fabrik Griesheim, Meitingen bei Augsburg. **Artificial carbon and electrographite** will be presented as materials of construction for chemical plant. Two products are being marketed under the names of *Diabon* (electrographite) and *Durabon* (artificial carbon). The former is relatively easily machined and has a heat conductivity of about 100 to 125 Kcal./mh.°C. On the other hand, *Durabon* is a very hard material which has good resistance to abrasion.

To meet the demand of several users for a material which was absolutely impermeable to gases and liquids, *Diabon* and *Durabon* are being impregnated with a special synthetic resin which is almost as resistant to chemicals as both of the original materials. However, there are certain limitations with regard to temperatures and the synthetic resin used at present will withstand about 165 to 170°C. Both *Diabon* and *Durabon* may be heated in a non-oxidising atmosphere to the highest temperatures used in practice, whereas oxidation commences at about 500°C. in an atmosphere containing oxygen. (O. 9—11, P. 9—11.)

Eckart Werke, Fürth in Bayern, manufacture **powdered and granulated metals,** particularly aluminium and bronze powders including gold bronze. They display their products and show applications in different branches of industry. (R. 5, S. 5.)

Anorgana GmbH., Gendorf. Some **anti-corrosive linings** will be exhibited, including various grades of hard and soft rubber stoving enamels; plastics for protection against oxidising agents such as nitric and chloric acids; and other exhibits. (K. 10—11, L. 10—11.)

Hall 2

Technical apparatus, machines, equipment, auxiliaries and complete plants.

Wiegand Apparatebau GmbH., Karlsruhe. **Evaporators,** etc. The company are showing as their main exhibit a compound evaporation plant consisting of a multi-stage pre-evaporator and a Luwa film evaporator as the final stage for the concentration of edible gelatine broths. The makers claim that higher concentrations can be achieved by means of this plant than by ordinary evaporators, with a negligibly larger steam consumption than the standard multi-stage apparatus. The company are also showing a multi-stage steam-jet exhauster unit made of porcelain and a small porcelain vacuum pump for laboratory or industrial use. The latter is a high-vacuum pump without moving parts which is corrosion resistant and sufficiently robust to stand rough handling under industrial conditions. (B. 29—30, C. 29—30.)

Luwa A.G., Zurich. Among the **process equipment** shown by this company will be spray drying and evaporation units. Luwa spray driers are designed in different sizes for evaporating from 8 to over 2,000 kg./hr. of water. They are adopted in the alimentary industry for milk (also with a high fat content), milk albumen, butter milk, curds, eggs, fruit and vegetable pulp, malt extract (also with vitamin additions), soup flavourings, tea and coffee extracts, yeast, pectin, glucose, etc. In the chemical and pharmaceutical industries they are used for manufacturing dry plasma preparations in the plastics and synthetic material industries, for adhesives, polymers, synthetic washing agents, textile auxiliaries, starch, tan, pigments, and the like. Some of the latest developments in evaporation will also be on show. (B. 31—32, C. 31—32.)

Krebs & Co., Berlin, design and build **chemical and electro-chemical** plant, *e.g.* for the manufacture of chlorine and caustic alkalis by electrolysis, for organic chlorination processes and for the manufacture of phenol from chlorobenzene and caustic soda. They have developed special heat exchangers for high temperatures. Their display consists mainly of photographic documentation. (C. 5—6.)

Maschinenbau A.G. Balcke, Bochum. **Plant and equipment for the chemical and allied industries.** This company will make a feature of its activities in the field of waste-heat utilisation. Exhibits will include a model of a cooling tower, a steam injector unit and a fuel oil pump. Other exhibits are described as: a fuel oil pump and preheating plant with oil furnace front; a peak-load boiler feed pump; a flat slide vacuum pump; a three-piston press pump; a rotary compressor and other pumps.

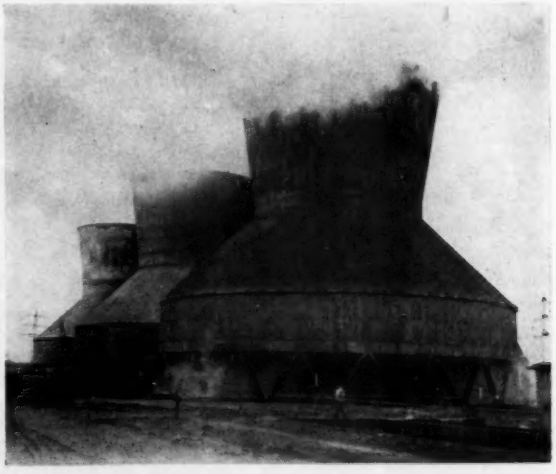
A showcase column will display 60 photographic transparencies conveying an impression of the firm's production range. (F. 11—14, G. 11—14.)

A. Mannesmann, Remscheid. **Emulsifiers, precision machine parts.** The firm exhibits amongst other articles their emulsifier in various sizes. This machine, with an hourly output of up to 2,000 l., can be used for the continuous production of emulsions and colloidal solutions, the homogenisation of the most different materials can be accomplished, the makers state, as well as the grinding of liquid and pulpy materials into infinitely small particles. According to the makers, this machine combines processes of an oscillatory, hydrodynamic and mechanical kind and employs them with the utmost effect on the substance being treated. The emulsifier has applications in various fields of the chemical, pharmaceutical, plastics, paint and food industries. (H. 1—2.)

Chemische Fabrik Budenheim A.G., Budenheim/Mainz. **Phosphoric salts, phosphoric acid, base exchange compound.** Exhibits will include a working model of a boiler feedwater softening plant using trisodium phosphate in the Budenheim process. Samples of the *Cefabu* base exchange masses made by the company are also being shown. These consist of an inorganic material coated with neutral synthetic exchangers having a capacity of from 14 to 15 g. CaO/litre of mass and with synthetic resin exchangers with a capacity of 35 to 36 g. CaO/litre of mass. These masses can be regenerated by means of common salt or by a mixture of salt and sulphuric acid and can therefore be used either as neutral exchangers or as hydrogen ion exchangers. (H. 4.)

Probst & Class, Rastatt. **Colloid mills.** The vibratory colloid mill manufactured by this company is used for grinding, dispersing, homogenising and emulsifying. This versatility makes the machine useful in widely different fields, such as in the manufacture of pharmaceuticals, cosmetics, chemicals, foodstuffs, beverages and condiments. The makers state that both liquid and solid emulsions of all kinds can be produced; for example, skin creams, mayonnaise sauce and fish-liver oil. It has also given excellent results in the dyestuffs industry for the production of very finely divided or dispersed substances, it is claimed. The homogenisation of fruit juices is among other applications.

The *Puc-Vikosator* vibratory colloid mill is steadily widening its industrial field of application and has recently been introduced in the soap and petroleum industries. It is used in the soap trade for grinding and homogenising the so-called 'detergent slurry' before being pumped to the top of the spray drying tower. The machine is employed in the petroleum industry in connection with the production of solid fats with low penetrometer values from oils. (H. 24—25.)



Three Balcke forced-draught cooling towers at a power station.

Hall 3

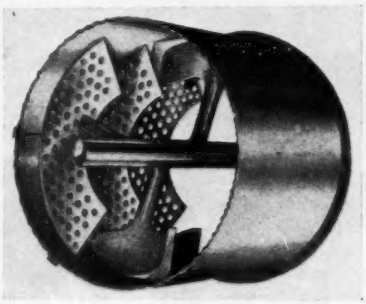
Technical apparatus, machines, equipment, auxiliaries and complete plants. Accident prevention.

Gebruder Lödige Maschinenbau-GmbH., Paderborn. **Mixing machinery** will be exhibited. The company's range of equipment includes mixers with rotary and with stationary vessels, continuous mixers, special mixers for wood waste and glue mixtures, special mixers for the plastics industry and mixers with heating and cooling jackets. An interesting model is the special mixer with rubbing-grinding elements. The makers state that these machines are particularly useful when mixing materials in which the destruction of the agglomerations is required, *e.g.* when oils, pastes, tomato concentrates, butter, lard, etc., are to be mixed into homogeneous powder products. It is stated that the extended impellers create a spreading action while rubbing against the rubbing-grinding elements attached to the cover, and a homogeneous product is obtained in 5 to 30 min. mixing time. (A. 14—15.)

Ernst A. Itterlein, Hannover-Kirchrode. A new type of **single-roll mill** has been developed, the *Perfecta*, in which the grinding pressure can be adjusted centrally without hydraulic devices. A degree of fineness can be obtained, it is stated, approaching that of a multiple-roll mill. A further new feature on this stand will be the non-metallic *Syntex* grinding bar made of a special plastic which is claimed to have many advantages, including finer grinding and non-discoloration of the material even in the case of the most sensitive colours. At the same time the risk of static electrical discharges is avoided, which is of prime importance in the case of nitro-cellulose lacquers. The new triple-roll mill *Hannover* will also appear. (B. 8, C. 10.)

An 'ultra-emulsifier,' with an output of up to 2,000 litres/hr., to be exhibited by A. Mannesmann.

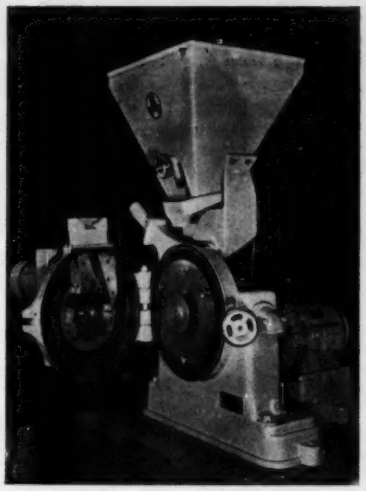
Fritz Scheibler, Wuppertal. **Filters.** This firm are exhibiting their universal filter for fine filtrations which is available in sizes with from 2 to 1,100 sq. ft. of filtering surface. This comprises a casing closed by a movable lid balanced by a counter-weight, and inside the casing independent filtering units are fixed so that they hang vertically side by side. The filtering units are formed by a collapsible frame of rectangular shape, on to which the filter bag is dressed before it is introduced into the casing. By use of a special construction and arrangement it is possible to use overall closed filter bags of threefold size.



View of the interior of a special mixer with rubbing-grinding elements attached to hatch cover for easy insertion, removal and quick cleaning. This mixer will appear on the stand of Gebruder Lödige.

The liquor enters the casing at the bottom and penetrates the bags from outside, and is filtered either by use of the cloth alone or with the additional use of suitable filter-aids in the precoat or constant-addition process. From the interior of the bags the filtrate is discharged into an open or closed gutter outside the casing. (B. 12—13, C. 14—15.)

Aerzener Maschinenfabrik GmbH., Aerzen bei Hameln, display their range of **rotary piston blowers,** the construction of which is based on the principle of the American Roots blower. The blowers are built for capacities up to 60,000 cu.m./hr. The standard machines are suitable for air, coal gas, methane, acetylene, ammonia, carbon dioxide, nitrogen, propane, hydrogen, oxygen and other pure gases. Special machines are available for poisonous and corrosive gases such as hydrogen sulphide, carbon monoxide, sulphur dioxide and chlorine.



This mill, the Microplex spiral air separator, a recent development, is for classifications down to a separation limit of 2 microns and allowing exact limitation of the range of granulation. Alpine A.G. will be showing it at Frankfurt.

A recent development is a compressor by means of which, the makers claim, air and almost all other gases can be compressed up to 2.5 atm. in one stage without contact with oil and with a high total diabatic degree of efficiency. This compressor is built for capacities up to 30,000 cu.m./hr.

The firm also shows rotary piston gas meters, which are used in the chemical industry for the measurement of hydrogen, nitrogen, ammonia, methane, propane, acetylene, etc. A small meter with a capacity of 500 cu.m./hr. and a special device separating 0.3% of the measured gas for laboratory use will be shown under working conditions. These meters are built for capacities up to 30,000 cu.m./hr. at 25 atm. A special meter has been developed for sugar factories.

Another exhibit is a rotary piston pump of a type which is stated to be particularly useful for factories making sugar, chocolate, soap or lacquers and where viscous liquids have to be pumped. (B. 14, C. 16.)

J. S. Fries Sohn, Frankfurt-am-Main, supply **apparatus for the chemical industry,** steel structures,

elevators and cranes. One exhibit will be a dense media separation plant built under licence from the Western Machinery Co., San Francisco.

This plant represents the latest development in gravity concentration. During the last few years the rapid development of flotation methods has overshadowed gravity processes. Flotation has been attempted in every field, often when simple and more obvious gravity concentration had not been fully investigated. It now appears, however, that flotation may be losing some of its pre-eminence and the appearance of the Wemco plant at Frankfurt may be the sign of a revival of gravity methods.

A special feature of the plant is the use of a drum separator and of a liquid with a much greater density than water. The plant can be used for metalliferous and non-metallic minerals as well as for coal and allows the working of deposits which cannot be concentrated economically by any other method.

Another exhibit is a laboratory mill driven by a 1½-h.p. motor. (B. 24, C. 26.)

Alpine A.G., Augsburg. **Pulverising machinery, air separators,** etc. A particularly interesting exhibit will be the *Mikroplex* spiral air separator for classifications down to a separation limit of 2μ. (D. 6—8, E. 5—7.)

Imperial Krauss-Maffei-Imperial GmbH. **Filters and driers.** The firm was formed to undertake the manufacture of the Krauss-Maffei centrifuges and Imperial filters and driers. A continuous pressure filter will be exhibited in which the cake is transferred to a vacuum tube drier by means of a specially designed sluice valve. This plant will be in actual operation, as well as a recently developed filter-concentrator which replaces the normal static decanter. A pre-coat filter will also be shown in operation. The section of the exhibit devoted to driers includes a pneumatic ring drier in which incompletely dried portions of the product are returned automatically to the drying channel. The centrifuges shown will be mostly continuous centrifuges and one of these has been specially designed for processing sugar. The company is also showing a 'decanter,' that is to say a drum centrifugal with helical channels, and also a new type of worm centrifuge. Another exhibit is a small centrifuge connected to a stroboscope by means of which the movement and separation of the materials can be observed. Batch centrifuges are represented by a discharging plough machine with automatic controls. (D. 18—19, E. 17—18, F. 20—21, G. 19—20.)

Carl Canzler, Düren. **Chemical plant and apparatus.** The display will include a laboratory stirrer with a capacity of 5 l. made of *Hastelloy B* and a large agitator of 250-l. capacity fabricated from mild steel clad with *Remanit HB*, an alloy which is equivalent to the American *Hastelloy B*. The firm are also showing a Shell *Turbogrid* fractionating tray, which is being manufactured under licence. This will be demonstrated in operation using water and air. An old-fashioned bubble cap tray fabricated from chrome-nickel steel, with a diameter of 4 m., will also be shown. Another exhibit is a reaction vessel for the production of synthetic resin with a capacity of 32 l. which is heated by means of a liquid medium and is fitted with automatic controls. The speed of the agitator can be varied from 0 to 1,500 r.p.m. and the type of blade can be changed to suit any kind of stirring or mixing process.

The company is also active in the field of induction heating and is showing a flow heater for high-pressure reactions in which the working temperature and pressure amounts to 350°C. at 200 atm. The high-pressure coil through which the product is removed also forms the secondary winding of a transformer.

Another example of induction heating will be an apparatus constructed of enamelled mild steel with induction coils mounted in the jacket. This plant will be shown in actual operation in which a high-boiling product is evaporated and subsequently condensed. In addition this stand will feature an autoclave with a capacity of 8 cu.m., a diameter of 1.4 m. and a total height of 7.6 m., made of Cr-Ni steel for a working pressure of 10 atm., fitted with an outer water-cooling jacket. Agitation is provided by 10 blades mounted on a common vertical shaft. The lower portion of a special cladded-steel cellulose kier is being exhibited. The diameter of the vessel is 5.6 m. and the height of the complete kier is over 13.7 m. A large horizontal stirrer made of bronze, about 2.1 m. diameter and 3.7 m. long, is mounted in the lower part of the kier. It is noteworthy that this unit, weighing about 2,000 kg., has been fabricated by welding forged and rolled metal parts. (F. 7—8, G. 6—7.)

Weineck & Co., Düsseldorf, supply **vacuum, cooling and crystallising plant.** An interesting apparatus they will exhibit is a steam-jet, high-vacuum laboratory pump. According to its size it consumes 2¼ or 4½ lb./hr. of 1.4-atm. steam in addition to the water consumption of an ordinary laboratory suction pump. The vacuum obtained depends on the temperature of the water and lies between 2 and 5 mm. mercury. It is essential that the steam is free from water; it should therefore pass a water trap before it enters the apparatus. The lower extremity of the pump dips into an overflow basin.

The apparatus can also be used to suck off corrosive gases or vapours, since the pump is manufactured in various materials including iron, lead, copper, aluminium and porcelain. (H. 4, J. 4.)

Seitz-Werke GmbH., Kreuznach. **Filtration equipment.** This company's display centres on two main exhibits—their drum-type sheet filter and single-sheet filter. The former is offered as the solution to many difficult problems associated with preliminary and fine filtration processes. The filter plate system is completely enclosed so that high-viscosity liquids, mother liquors, molten materials and chilled products can be treated at a constant temperature. The apparatus can also be used for the filtration of volatile, inflammable or toxic products without loss. The horizontal arrangement of the elements permits a uniform production of filter cake over the whole surface so that washing is carried out with a minimum quantity of liquid. The resistance of the filter is low and high outputs are obtained even with high-viscosity liquids. Another characteristic is that the filter can be easily cleaned and drained.

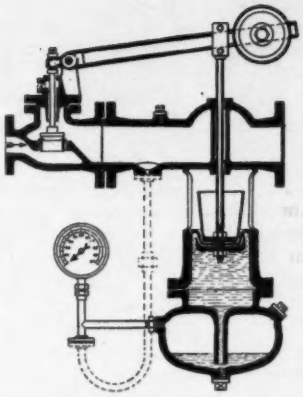
The single-sheet filters combine the filter and pressure tank in one unit. They are convenient for the filtration of small charges and for separating, washing and drying of relatively large quantities of solids in the form of a thick cake. (H. 16—18, J. 16—18.)

Haver & Boecker, Oelde. **Sieves, screens, packing machinery; wire cloth.** This company's activities include the manufacture of machines and apparatus for feeding, screening and packing of granular, gritty and powdered products of all kinds. Valve bag-packing machines, *Niagara* vibrating screens with outputs up to 600 tons/hr., a lighter vibrating screen with unbalanced central drive for medium-fine products and other screens are included in the range. Apparatus for

the taking of samples at different stages of any manufacturing process will also be represented, along with silo vibrators, an electrically controlled silo outlet device, feed devices for various charging operations, and bin-level indicators. Another side of the company's activities is the production of wire cloth in various metals. (H. 24, J. 24.)

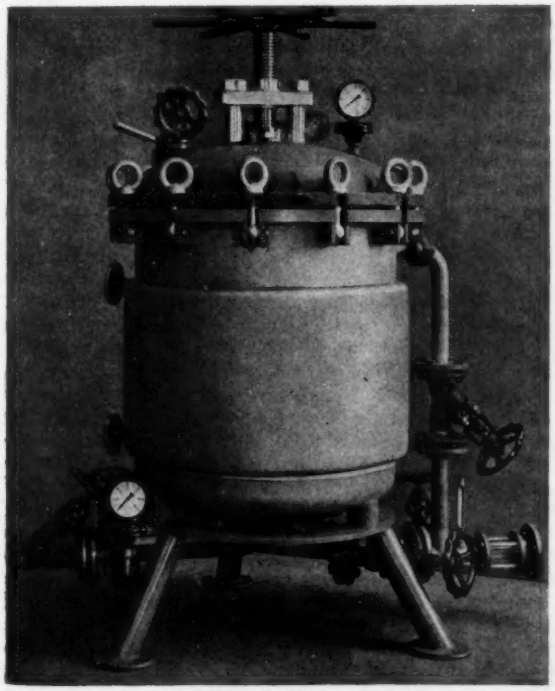
Amag-Hilpert-Pegnitzhütte A.G. **Pumps, valves,** etc. Among this company's exhibits will be the CBK-process pump with body and interior parts in *Bascodur* plastic, which is stated to be resistant to a number of acids and aggressive chemicals at temperatures up to 302°F. A new development, the CFM pump, is contained in a common housing with the driving motor. Other types of pumps will be shown, along with acid valves. (B. 25, C. 27, D. 28, E. 27, F. 28, G. 27, H. 27, J. 27.)

Gustav Mankenberg, Lübeck. The firm manufactures a wide range of **special fittings** and, in addition to the original *Niagara* steam traps, the new types, *Corona* and *Vineta*, are particularly noteworthy. The *Corona* is claimed to withstand rated pressures up to 320 kg./sq.cm. and temperatures of up to over 500°C. The *Vineta* type represents a steam trap with an open bell-shaped float and a valve which has been constructed to facilitate automatic venting in cases where there are wide fluctuations in the quantity of condensate. Many float-operated regulators are used for various technical processes and a small selection of these is being shown.



Scheme of the 'Gloria' micro pressure regulator, with diaphragm, which will be exhibited by Mankenberg.

Of particular interest to the process engineer are the pressure-reducing valves and pressure regulators for various purposes. The pressure-reducing valves *Odin*, *Komet* and *Merkin* are being exhibited, as well as a *Gloria* micro pressure regulator. In addition, a mechanically operated pressure regulator is being shown under working conditions. Various special fittings are also being exhibited on the Mankenberg stand, including dirt traps for building into pipelines, flow indicators and control apparatus. (K. 6 and 7.)



A drum-type sheet filter to be shown by Seitz-Werke.

Hall 4

Technical apparatus, machines, equipment and complete plants. Machinery and plant for the production and processing of plastics.

Newman, Hender & Co. Ltd., Woodchester, Glos., England. **Valves.** This company are showing the Newman-Milliken glandless lubricated plug valve. This is very simple in construction, but the makers claim that it is free from the usual defects of the ordinary plug cock. The valve comprises eight components and has only one moving part, the parallel plug. This, it is stated, is never raised from its seat when the valve is operated, but rotates freely in a film of insoluble plastic lubricant. Typical installations are on creosote-oil and ammonia-liquor lines, and for controlling coal gas used for heating coke ovens. The valve is manufactured in sizes from ½ to 12 in. (both screw and flanged) and for working pressures up to 3,000 p.s.i. (A. 12.)

Rifox Spezialarmaturen GmbH., Bremen. **Steam traps, valves,** etc. This company are exhibiting a new form of float steam trap incorporating a steam meter and a rotary gate control valve. The advantage of this apparatus is that it is possible to check the steam consumption of even the smallest pieces of equipment, which is often of considerable economic importance. The initial cost is little more than that of an ordinary type of steam trap. The company is also showing a new compressed-air cleaner and drier. This combines the effect of a centrifugal jet with that of a filter made of sintered metal. Moisture and dust are removed by super cooling brought about by a reduction in pressure in a cyclone and the air stream is then passed through the filter. The action of the drier can be observed during operation through a transparent connecting tube made of *Plexiglas* and adjustments to the jet made from outside the apparatus. (A. 13.)

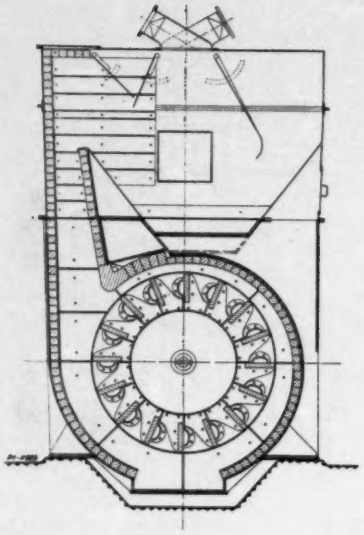
G. Schanzenbach GmbH., Frankfurt-am-Main, manufacture **electric light fittings** to meet the special requirements of the chemical industry. These include dust- and moisture-

proof lamps for attaching to the ceilings or walls or for building into pipe flanges or with a dust-deflecting upper surface for lignite processing plant; fluorescent lamps, with or without reflectors, in which the tubes are freely accessible but the switchgear is housed in watertight boxes; and acid bath lamps, a special fitting for fluorescent tubes made of *Plexiglas* tubing which can be immersed in acid. The company are also showing explosion-proof electrical equipment including pressure-proof plugs and sockets for d.c. and a.c. up to 25 amp. which cannot be involuntarily disconnected under tension. Other exhibits include searchlights for industrial purposes. (C. 8.)

Kohlenscheidungs GmbH., Stuttgart. **Boilers, hammer mills,** etc. Exhibits will include *Plexiglas* models of cyclone boiler plants and hammer mills as well as a series of photographs and plans of installations which the company has erected. The cyclone boiler has been designed with a view to obtaining the maximum loading of the combustion chamber and to attain higher temperatures than have hitherto been possible so as to liquefy the coal ash. Streams of coal dust and air are introduced tangentially so as to obtain a centrifugal effect which causes a rapid deposition of the droplet of ash. The maximum firing load of the cyclone boiler is about 0.9 to 1.0 $\times$ 10^6 Kcal./cu.m./hr.

The coal-dust firing appliance consists of two opposed burners through which a mixture of coal and air is injected at a high velocity into the combustion chamber. The liquid ash is withdrawn at a central point of the hearth and is granulated in water. The KSG hammer mill does not require a separate blower for the supply of hot air or flue gas required for drying and conveying the coal dust to the points at which it is used. The impact grinding wheel also acts as an impeller for providing the necessary pressure for the movement of the gas or air stream. The mills are manufactured in two types: model *S* for hard coal and model *N* for lignite. The KSG hammer mill not only serves for grinding and drying coal dust but forms an essential component of the firing system. (D. 5, E. 5.)

Frieseke & Hoepfner GmbH., Erlangen-Bruck. **Plastics machinery, thickness gauges,** etc. New types of extruders and vacuum moulding machines will be shown. The extruder is fitted with a worm and a means of variable feedback so that it can be used with all thermoplastic materials, in the



Section through a K.S.G. impact mill (type S) to be exhibited by Kohlenscheidungs.

form of powder or granules, to obtain scientific data on the behaviour of the material under the influence of the worm or in various types of simple or complex dies and nozzles. A die with a variable opening enables many different types of thermoplasts to be processed with the same worm. The *Formvac Junior* is an automatic machine for producing mouldings from hard or soft thermoplastic sheet under vacuum. The automatic method of operation has been simplified so that the machine can be used successfully by unskilled personnel. As the moulds can be made of metal, wood or plaster, small numbers of mouldings can be produced at a low cost.

This firm are also showing a range of instruments involving measurement of radioactive radiation. These include an apparatus for continuous determination of surface weight and thickness of materials. The instrument can deal with surface weights of from 10 to 23,000 g./sq.m., which correspond to metal foil of only a few thousandths of a millimetre in thickness up to steel strip 3 mm. in thickness. The material which supplies the radiation is selected according to the range of thickness under consideration. The degree of accuracy depends on the unit weight of surface. With material of under 100 g./sq.m. the limit of error is 1%, which in the case of paper corresponds to a variation in thickness of about 0.001 mm. Thicker materials can be measured with an accuracy of less than 1%.

The *Radiameter*, type F.H. 40H, is a portable instrument used for the measurement of gamma rays and for the detection of beta radiation. It is used for the determination of the degree of protection from radiation in *x*-ray installations and where radioactive materials are being employed. Operation is by means of standard 1.5-v. cells weighing 900 g. The counter is a very sensitive instrument with two scales of measurement: 0 to 25 mr/h. and 0 to 1 r/h. The *Radiatector*, type F.H. 40M, is used for the detection of radioactive substances out of doors or in the laboratory. It is a counter with high sensitivity which gives audible signals by means of a stethoscope. It is stated to be particularly suitable for use in connection with technical or medical applications involving radioactive isotopes and also for qualitative geological investigations on account of its rod-like shape and low weight of 900 g. (H. 1—6, J. 1—6.)

Theodor Zeise, Hamburg-Altona. This stand will exhibit a range of propeller **stirrers and mixers** which are used in industrial processes. These include the production of uniform mixtures of liquids and of liquids with solid or gaseous materials, the acceleration of physical and chemical processes, emulsification and homogenisation, and the promotion of the efficiency of refrigeration and heat exchange. The propellers are available in various sizes from small laboratory models coupled directly to motors up to pieces of 2.5 m. in diameter. The latter are provided with fixed or variable gearing. The blades and shafts are available in cast iron, steel, acid- or wear-resisting materials as required. (K. 12—13.)

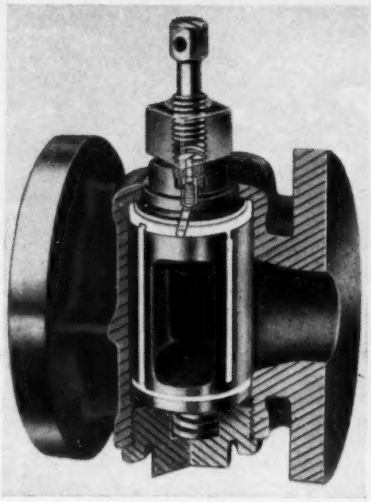
'Rhewum,' Remscheid-Luttringhausen. **Sieving machinery.** Vibrating screens, feeder vibro-agitators, vibro-dusting plant and laboratory sieving apparatus are manufactured. The company are exhibiting vibratory sifting and classifying machinery which has been specially designed for the sugar industry. One of these machines separates the crystallised product into four qualities with a different range particle size, each of which is entirely free from dust. The power consumption is extremely small and amounts to only about 800 to 1,000 w./sq.m. of screen surface with a rated capacity of 10,000 kg./hr. Other types of machines are used for sifting ground sugar into various degrees of fineness. The makers point out that one of the chief advantages of this process is that the meshes of the sieves do not tend to become clogged. (K. 14.)

Hall 5

Plant, machinery and equipment for chemical science and technology.

Hans Gilowy Maschinenfabrik 'Meteorwerk,' Berlin-Schöneberg, supply **bottle-cleaning and -drying machines** and exhibit their *Meteor* automatic rotary rinsing machine, which cleans all types of flasks and bottles inside and outside. The rinsing liquid can be separated and recovered. Different sizes of flasks can be rinsed simultaneously and it is stated that the smallest flasks will be rinsed thoroughly without being tossed up by the water jet. Power consumption is ½ h.p. and the capacity is up to 4,000 bottles/hr. (A. 9.)

Herfurth GmbH., Hamburg-Altona, are exhibiting apparatus for the **measurement and neutralisation of static electrical charges.** The *Statometer* is used for the exact determination of the field intensity of static charges from the point of view of ascertaining their cause and for determining the means of neutralisation. It is a portable instrument operated by means of a battery which rapidly responds to very small static charges without actual contact with the charged material. The *Registrier Statometer* is used for the measurement and continuous control of static electricity in industrial processes. This instrument is built into the machinery and the readings are recorded by means of a scriber. Spitzen 'ionisators' represent a new form of apparatus which has been found very effective in neutralising static charges. An 'anti-static air gun' is a new form of apparatus which is used for removing dust which had been attracted to the surface of objects by static charges, while a further apparatus has been developed for testing the safety of areas which had been exposed to radioactivity. The instrument operates on the ionisation principle and gives a full-scale deflection with as little as 40 r.m./h. The contamination meter H. 1307 serves for detecting the presence of radioactive material on clothing or other objects by means of a G.M. counter, which by virtue of its great sensitivity and logarithmic scale, covers as wide a range as from 0.5 to 40 m.r/h. The radiation testing apparatus H. 1305 is a small portable instrument which can easily be carried in a coat pocket. It is very sensitive and can therefore be conveniently used for such purposes as tracing lost radioactive materials. The instrument gives an audible signal.



Lubricated parallel-plug valve to be shown by Newman, Hender & Co. Ltd. Of simple construction, the valve is suitable for handling acids, caustics, chemicals, oil, water, air, gas and vacuum.

The company also manufactures a pocket 'dosimeter' which is used in conjunction with the 'measuring and charging apparatus' H. 1700. The former consists of a small tube, 10 cm. in length, containing an ionisation chamber, which is intended for use by a relatively large number of persons. The charging and subsequent determination of the radiation dose is carried out by the measuring and charging apparatus, which incorporates an electronic measuring device. The instrument is available to cover various ranges of measurement. (C. 5.)

Jagenberg-Werke Akt.-Ges. **Packaging and labelling machines,** etc. Packaging exhibits will include the *Eco-Pac* container and machinery connected with the use of this form of packaging, which was specially developed for the deep-freezing industry and is used for various food products. Other exhibits will include labelling machines and a machine for gumming and glueing, boards, leathers, etc. (F. 5—7, G. 5—7.)

Gotthard Allweiler Pumpenfabrik A.G., Radolfzell. Suppliers of **pumps.** This company are displaying their screw pump which, originally built for pumping oil and lubricating liquids, has proved to be equally suitable for use with non- or poorly-lubricating liquids such as gasoline, diesel oil or water. The volumetric capacity is in direct proportion to the number of revolutions and the medium is carried in axial direction without turbulence. Axial thrust caused by the pressure of liquid and by the priming engine are hydraulically eliminated. Constant volume and velocity are attained and there is no squeezing of the liquid.

These screw pumps are made in series within a delivery range of from .2 to 2,200 l/min., against pressures of up to 20 atm. for continuous running. For viscosities of more than 10° Engler the working pressure may exceed 20 atm. The pumps are available both horizontal and vertical. (H. 1.)

J. D. Möller Wedel Optische Werke GmbH., Wedel/Holst. **Optical goods, spectroscopes,** etc. A selection of precision-ground optical goods in the form of prisms in various degrees of complexity, lenses, glass plates and mirrors will be exhibited and also a series of pocket spectroscopes which have a number of scientific and industrial applications. The display will also include a number of goniometers ranging from precision instruments for scientific research and for the optical industry to more simple portable apparatus for general use. (K. 6.)

Hall 7

Laboratory equipment, apparatus, machines and auxiliaries. Technical instruments for measurement and control, literature display and safety appliances.

Hans Heidolph OHG., Schwabach, exhibit **small motors, small pumps** for liquids, air pumps and small stirrers. The monophase motors with squirrel-cage rotor and speeds from 3,000 r.p.m. to one revolution per day are suitable for laboratory use. The pumps are built for capacities of 20 and 100 l./min. with a delivery head of 1 m. (39 in.).

As a novelty the firm displays a small stirrer which produces at low power consumption a rapid and complete mixing of liquids of all viscosities. It is fitted with infinitely variable gearing. A special low-speed shaft with a high moment of rotation is available for the mixing of viscous liquids. (A. 19.)

Ludwig Grefe Maschinenfabrik, Ludenscheid in Westfalen, are showing their range of **flow meters, indicators and regulators.** The Grefe meter consists of a valve with dome and crest. The liquids or gases to be measured pass inside the valve

through a long, vertical, cone-shaped chamber fitted with a movable float. The position of the float depends on the quantity passing through the chamber. The upper part of a hollow spindle, which is fixed to the float, moves in a glass tube. No stuffing box is used and the apparatus works without friction. An enamel scale fixed behind the glass tube allows direct reading of the quantity flowing through the apparatus calculated per second, per minute or per hour. The meter can be built in like any other valve and requires no special attention. A measuring accuracy of $\pm 3\%$ is claimed.

The meter can be fitted with an alarm clock which rings as soon as the flow stops or varies within certain limits. If remote control of the flow is required, the spindle is replaced by an iron core which moves inside an induction coil. The fluctuations of the impedance caused by the movements of the core are used to actuate an indicator or a recording apparatus. The meter is made in various materials. (A. 20.)

Laboratorium Prof. Dr. Berthold, Wildbad, are exhibiting several types of **Geiger counters** and other forms of specialised apparatus. The former include a large isotope-measuring apparatus with a resolving power of up to 30,000 statistic impulses/sec., five decadic stages, synchronic clock and time and impulse pre-selection for exact determinations. The apparatus can be used in conjunction with a sample changer with automatic flow and time regulation devices. Another exhibit will be a counter/interference goniometer connected to an amplifier for *x*-ray fibre structure determinations, spectro-analysis and investigations on crystal lattice orientation. A third counter is for liquid-level determination and control in high-pressure vessels, reaction chambers, autoclaves and other containers, while counter 'Diff/S' is for the determination of wall thickness and the presence of cavities.

There will also be a battery counter apparatus for mineralogical investigations; various types of counters; several forms of magnetic apparatus for the determination of the thickness of layers and for the detection of cracks; and wire-rope-testing apparatus for the determination of the breaking strain of wire ropes of up to 80-mm. diameter and over. (B. 2.)

Drägerwerk Heinr. & Bernh Dräger, Lübeck. **Breathing apparatus, gas detection,** etc. Exhibits will include a self-contained oxygen breathing apparatus for mines, etc., this being an easily portable apparatus with regeneration of exhaled air. Another exhibit, a compressed-air breathing apparatus, is also a self-contained type carried on the back. Various canisters and filters will also be on view.

The model 31 gas detector is for use with the most frequently encountered industrial gases and is designed to take semi-quantitive estimations which may be read on the site. Various other items of equipment will also be shown. (B. 29—30, C. 29—30.)

B. Braun, Melsungen, **Warburg apparatus, thermostats and physiological apparatus,** will be exhibiting a new form of recording instrument which gives simultaneous readings from 14 separate points of a Warburg apparatus. This instrument is stated to be particularly suitable for measuring very small fluctuations of pressure as the sensitivity is 10 times greater than that of the standard Warburg manometer. The operation of the instrument is based on the measurement of capacity, which is carried out at 2-sec. intervals at each point. Differences in capacity are automatically transformed into movements of the recording device. A range of the various standard types of the Warburg apparatus are also being shown, these being all fitted with the popular form of double capillary manometer. Another item of interest is a reaction vessel in which two liquids can be mixed by means of magnetic stirring, without the necessity of taking the manometers out of the thermostatically controlled water bath, so that fluctuations of temperature can be avoided. (B. 41a, C. 41a.)

Erweka Apparatebau GmbH., Frankfurt-am-Main. Suppliers of all types of **apparatus for the pharmaceutical laboratory.** The new Stada multi-purpose machine which will be exhibited has one driving unit for the operation of 15 different items of apparatus which can be mounted on the driving unit as required. One such item is a three-roller mill for producing ointments and pastes, while another is a homogeniser for the preparation of both water-in-oil and oil-in-water emulsions in pharmacy and socmetics. (C. 25—26.)

Rubarth & Co., Hannover, **drying stoves, incubators,** etc., are showing a large selection of laboratory and industrial apparatus including water baths, sand baths, inactivating baths, hot plates with automatic temperature regulation, drying and air-conditioned cupboards and photoelectrical thermostats. An item of particular interest is an incubator incorporating a refrigerator, which covers a range of temperatures from 0 to 50°C. (C. 31.)

C. Schliessmann Kellerei-Chemie K.G., Schwabisch Hall. **Carboys, syphons,** etc. This company is exhibiting a novel form of glass carboy fitted with an emptying device for the storage of chemicals and liquids of all kinds. Containers with capacities of from 10 to 50 l. are stacked on wooden racks one above the other with considerable saving of space. The emptying devices are made of various materials according to the nature of the liquid and can be supplied in pure aluminium, acid-resisting plastics or stainless steel. The company also manufacture carboy tilting and emptying appliances for use with acids and other corrosive liquids. These enable small quantities of the liquid to be withdrawn and accurately measured or larger quantities to be run off without the necessity of using compressed air. (C. 45.)

Julius Peters, Berlin. **Calorimeters, apparatus for materials testing.** This stand will feature some interesting combustion bombs, these being small, compact receptacles in which combustion can be carried out in pure oxygen under pressure. A number of instruments and accessories will also be shown. One combustion bomb is fitted with a window through which the process of combustion can be observed. Apparatus for testing the stability of gasoline under conditions of accelerated oxidation will make a further exhibit, along with a device for determining the evaporative capacity of lubricating oil for combustion engines. An apparatus that is likely to attract some attention is described as an oxidising apparatus for rubber and similar substances in which ageing occurs as a result of heat and oxygen at a temperature of 60 to 70° and a pressure of 20 atm. This apparatus comprises one or two autoclaves with internal diameter of 100 mm. and length 500 mm., arranged horizontally in a bath. Electric heating is employed. (D. 7.)

The Frankfurt Institute of the Battelle organisation for **industrial research** will have a stand in this hall (see page 141). The following five groups have been set up at Frankfurt: chemistry, physics, ceramics, metallurgy and mechanical engineering.

Edmund Bühler, Tübingen. **Automatic elementary analysis, thermostats, homogenisers.** A range of laboratory apparatus which includes a number of novel features will be shown. The most interesting of these is a separation battery devised by Hecker, which is used for the isolation of substances from mixtures, for testing the purity of substances and for the production of analytically pure materials, using the counter-current principle. This apparatus was devised in the Max Plank Biological Institute in Tübingen and, it is stated, has given excellent results in the form developed by this firm. An ancillary apparatus is a new type of evaporator for the mild reduction to dryness of solutions produced in this and other similar processes.

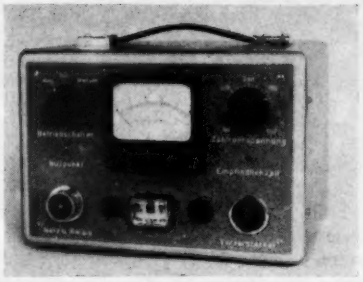
In the field of electric laboratory heaters, a new form of reflecting radiator devised by Klein is being shown. This apparatus is characterised by its adaptability as a hot plate for many different types of vessels, high output (1 kw.) and ease of temperature regulation. This type of heater is also made in the form of a low stand with supports for ash determination.

Another interesting apparatus is a small thermostat for blood tests, which is suitable for use with the various tubes and dishes usually employed for this purpose. A new form of powder-mixing machine is also being exhibited which is characterised by the rotation of the mixing vessel in two axes.

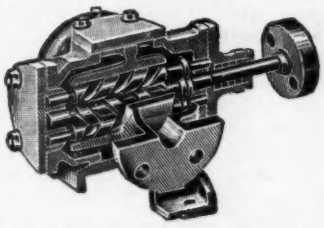
A number of improvements have also been made to well-established lines, notably the electric automatic apparatus for elementary analysis devised by Reihlen and Weinbrenner, which is now being supplied with a temperature regulator. A further new development is an homogeniser used for research work which is fitted with special ball-bearings so that speeds of up to 50,000 r.p.m. can be attained. (D. 30.)

Dipl.-Ing. W. Ehret GmbH., Emmendingen (Baden), are showing their range of **electric incubators** for breeding temperatures up to 140°F. (60°C.). They are of cubical shape and made of plywood or metal with a lining of pure aluminium for easy cleaning and sterilisation. All models are equipped with movable, perforated shelves, ventilation, and thermostatic control fitted with thermometer and two signal lamps for the supervision of the temperature.

The thermostat of model *M* is of the diaphragm type and maintains temperatures within ±0.5°C., whilst



This apparatus for liquid-level determination and control in high-pressure vessels, etc., will appear among the Geiger counters exhibited by Labor. Prof. Dr. Berthold.



The Allweiler screw pump, which is suitable for handling liquids of low viscosity.

model *F* is equipped with an expansion-type, relay-operated thermostat which maintains temperatures within ±0.1°C. and is easily adjustable to any desired temperature. Both models are available with water cooling, breeding chamber illumination and alarm clock.

The incubators are built for a.c. and d.c. and voltages from 110 to 250. The time required to step up the heat from room temperature to 140°F. is 2 hr. The temperature is uniformly maintained within the entire breeding chamber. (D. 31.)

Ludwig Pusl, München, are exhibiting a selection of instruments for ***p*H determination.** Among these is the universal *p*H *Ionenmeter*, a high-precision apparatus for use with all types of electrodes for scientific and industrial research. It covers a range of *p*H values from 0 to 14 and millivolt readings up to 1,400. The sensitivity is 0.005 *p*H or 0.5 mv. The apparatus is also a high-precision apparatus of simpler construction and with a more limited range of up to *p*H 11.5 and 0 to 350 mv. The *p*H *Ionoskop* is a portable apparatus for industrial use in the factory or in a works laboratory. It has a range of *p*H values up to 13.3 and two scales for millivolt readings of from 0 to 314 and 310 to 1,018. The sensitivity is *p*H 0.02 or 2 mv. The *p*H *Kolorimeter* represents the simplest form of apparatus and is intended for general purposes. Transparent film impregnated with indicator dyestuffs are used for tests involving a comparison with a standard colour scale. The company are also showing a representative selection of their range of calomel, glass and calomel/glass unit electrodes. (D. 36.)

David & Baader, Kandel/Pfalz, specialise in the manufacture of **electric apparatus** and **heater elements.** They are exhibiting a range of drying cupboards and stoves which are fitted with precision heat regulators and with horizontal or vertical air-circulation systems. The interiors are available with wire-mesh or sheet-metal trays, or with suspension racks or wheeled trucks.

The company are also showing heater elements and units for all types of electric apparatus and machines as well as finished products. These include such articles as space heaters, food heaters, electric blankets, milk feeding bottle heaters, etc., for domestic and industrial purposes. (D. 42.)

Battelle Memorial Institut für Deutschland, Frankfurt-am-Main. A kiosk at the exhibition will give visitors an opportunity of getting information about the aims and the methods of the organisation. The Battelle Institute was founded in 1929 at Columbus, Ohio, by the will of Gordon Battelle. He was impressed with the benefits to be derived from **industrial research** and left his estate for the building and endowment of an institute for the encouragement of research and the making of discoveries and inventions for industry.

The Frankfurt Institute was established in 1952 as part of the European research service of the Battelle foundation. It provides on a no-profit basis the plant, equipment and personnel for conducting research. (D. 55—56.)

Hall 8

Machinery, plant and processes for chemical technology and for gas and water techniques.

Stahl-Armaturen GmbH., Belecke, are exhibiting a selection from their range of **valves.** The company engage in the production of forged parts from normal and special steels and from non-ferrous metals which are designed to withstand the most exacting conditions of temperature and

pressure experienced in modern industrial plants and also to resist corrosion, abrasion and attack by chemicals. Welding plays a major part in the assembly of heavy-duty valves using forged components. Various types of valves are being shown including globe valves, gate valves, Y- and angle-pattern valves, needle valves, check valves, and acid and ammonia valves. (C. 7—8.)

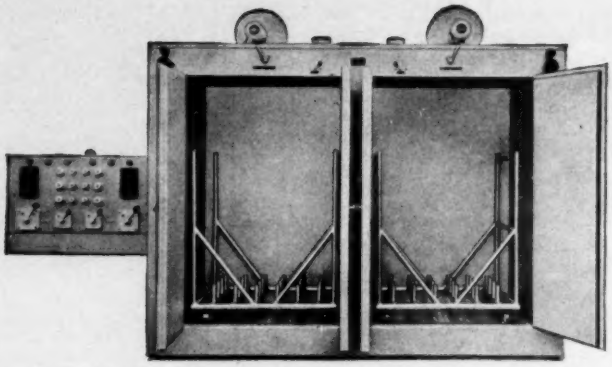
Bran & Lübbe, Hamburg, specialise in the manufacture of apparatus used in connection with **water treatment.** Their exhibits will include several types of photoelectric analytical apparatus, such as the *Durometer*, for the fully automatic discontinuous determination of residual hardness (Ca, Mg); the *Silikometer*, for the fully automatic discontinuous determination of silica; the *Chlorometer*, for the fully automatic discontinuous determination of chlorine or ozone; the *Phosphatometer*, for the fully automatic discontinuous determination of the excess of phosphate (P_2O); an automatic titrometer—an indicating, recording and regulating titrometer used in connection with reactions involving neutralisation, oxidation, reduction or the formation of complexes; *Chromoflux DF*, for the continuous estimation of coloured solutions and of turbidity with or without a recording device; and a fully automatic apparatus for the continuous or discontinuous determination of traces of gases. (F. 4; also in Hall 10, Stand A. 10—12.)

Chlorator GmbH., Grotzingen/Karlsruhe. **Water purification apparatus,** etc. This company developed many years ago a 'residual chlorine recorder' which transcribes on a paper chart a continuous and permanent record of the amount of residual chlorine in water after the sterilisation process. In further development and application of the same principle, a controller has been evolved which automatically maintains the chlorine residual at the desired level. It is stated that this apparatus can be used for all operating conditions. (F. 5—6.)

Hall 9

Machinery and plant for chemical technology, particularly for weighing, forming and packing.

Wilhelm Thomas Blechwaren Fabrik GmbH., Kaan-Marienborn. The company are exhibiting a range of their **safety transport containers** for bottles. These consist of a sheet-metal casing with interior supports and a layer of shock-absorbing material which provides an effective protection for the gas vessel during transport. The metal shells are made in two types: the *T.V.* model with a flat top, and the *T.H.* model with a domed head to accommodate the neck and opening of the bottle. The former has the advantage that the containers can be stacked directly on top of each other and so save shipping space. Wood shavings are generally used as the shock-absorbing material, but in certain cases slag wool or other inorganic substances are preferred. The metal casings are usually painted with a red rust-resisting finish or can be supplied in special colours or coated with acid-resisting materials. The rapid-closure devices can be conveniently sealed. (F. 5.)



Drying cabinet which will be exhibited by David & Baader.

Hall 10

Machinery and plant for weighing, forming and packing.

Fritz Collischan, Nürnberg. This company will be exhibiting their electro-automatic **weighing and filling machines.** (A. 7.)

Hoefliger & Karg, Waiblingen. **Automatic filling** and **packaging machines** for the chemical and pharmaceutical industry. Exhibits will include a machine for filling and sealing 180 penicillin vials per min. The sterile vials are put on a conveyor belt and fed into the filling machine. After filling, the vials are automatically closed with rubber stoppers and aluminium caps.

The machine is capable of handling dry products as well as aqueous or oily suspensions. The entire operation takes place under sterile conditions, making a subsequent sterilisation unnecessary. The lower driving part is completely separated from the upper filling part. Safety devices prevent fillings, rubber stoppers and aluminium caps from being released, if no vial is in position at the respective station. The sorting devices for the stoppers and for the caps can be adjusted to the speed of the machine. Weights can be checked during the operation without any loss of time. (D. 1—2, E. 1—2.)

Alexanderwerk A.G., Remscheid, supply **granulating and mincing machinery.** They are showing for the first time a granulating machine working on a new principle, by means of which granules of various grain sizes and hardness can be produced from organic and inorganic products. Grain sizes of between 0.01 and 0.24 in. diam. can be obtained, and in some cases even larger sizes, simply by changing the cylinders.

Cylinders, corresponding to the desired grain size, counter-rotate at different speeds. The material to be granulated is taken from the hopper by means of a rotary mixing table, fed on to the cylinders and rubbed into the holes. The material is thus subjected to compression as well as a shearing effect. The granulated material runs out of the cylinder openings in front. This method, it is stated, ensures a completely continuous working process and a permanently constant diameter of the grains as well as excellent hardness. The processed material does not heat up to any extent even during continuous working.

For granulated materials from 0.12 in. diam. the granulating cylinders carry perforated sheets 0.16 to 0.59-in. thick. The cylinders proper serve in these cases as supports. From .118-in. hole diameters onwards the cylinders

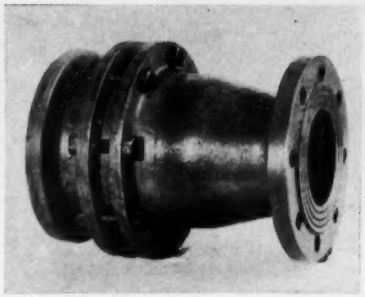
are drilled and the thickness of the cylinder walls is adapted to each individual case. The thicker the wall the more strongly is the granulated material compacted. However, even with very small grain sizes, *e.g.* .012-in. diam., the granulated materials reach great resistance, although actual friction in the holes (.012 to .020 in. length of holes) and hence the compacting of the material are small.

The granulating machines are used in the intermediate process of manufacturing tablets, where small grain sizes with a determined share of fine material are required and also with manufacturing processes where, by reason of further processing, dust-forming materials must be made into larger granules or small rods, largely free of any fine material. Granules are formed out of dust or powder-like materials which are fed into the machine in a moist state (moisture content between 5 and 15%). (E. 6-7.)

Hall 11

New chemical products for all branches of chemical technology. Apparatus, machinery and auxiliaries for chemical science and industry.

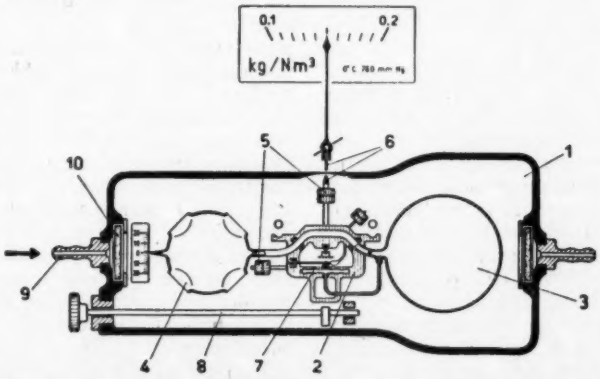
C. Conradty, Nürnberg. This firm, which is celebrating the 100th anniversary of its foundation, is exhibiting a range of **carbon products,** including electrodes for heating and electro-chemical processes, *Cecolit* corrosion-resistant bricks and mouldings, *Cecobon* gas- and water-impermeable bricks, *Ecefit* graphite-coated carbon constructional materials, and *Ecebon*, a graphitic constructional material for chemical plant which is impermeable



The ' Hydrostop ' non-return valve, to be exhibited by Vereinigte Armaturen GmbH., can be used instead of hydraulically-operated gate or globe valves of the usual type. It incorporates a longitudinally folded diaphragm as the closing element.

to gases and liquids and has a wide field of application owing to the ease with which it can be shaped and worked. (D. 4—5, E. 4—5.)

Pollux GmbH., Ludwigshafen. **Measuring instruments.** This company will exhibit a flow detector consisting of a sensible flow indicator and a mechanical throttle valve releasing device; this acts as a pipe-burst safety device for pipelines. There will also be an integrating calorimeter which measures the quantity of heat taken away by heating installations from a closed-circulation system of flowing water. Perhaps the most interesting exhibit will be a gas-density recorder which works on the buoyancy principle. The lifting force of a displacement element, which is dependent on the density of the gas, is measured. The apparatus can be used for physical experiments as well as for regular service control. (F. 9—10.)



Gas density recorder to be shown by Pollux. The diagram shows the gas chamber with measuring mechanism. Key to numbering: (1) Gas chamber; (2) Balance arm with knife-edge mounting; (3) Closed lifting ball; (4) Open glass counterweight; (5) Adjusting weights; (6) Magnetic coupling; (7) Pressure gauge box with automatic correction of the atmospheric state; (8) Fixing device; (9) Gas inlet branch; (10) Protection filter.

Other exhibits will include the following (Hall and Stand Nos. not known at time of going to press):

Josef Deckelmann, Aschaffenburg. **Ointment machine; tube-filling machinery.** The Hammonia ointment machine, which has been available for some years in a form suitable for pharmacist and research laboratories, has recently been brought on the market in an improved type which can be used not only for making ointment to recipe but also in larger quantities. This machine, which will be exhibited at the Achema, may be used in industry for making small quantities.

The machine, comprising a triple-roll mill with a built-in motor rendering ⅛ h.p., has porphyry rollers of 100-mm. length and 50-mm. diameter and is stated to be suitable for the making of the smallest quantities as well as—by the use of a funnel holding about 1.5 kg.—for delivering an hourly output up to 20 kg. The machine is also available with a speed regulator which permits, during operation, the adjustment of the speed of the rollers to suit the substance to be ground. The machine with the speed regulator is especially recommended by the makers for the production of liquid, oily or water preparations.

The dimensions of the machine are: length, 45 cm.; width, 27 cm.; height, 30 cm.; while the net weight is about 15 kg. By varying the clearance of the rollers any required fineness of product can be achieved.

Hans Freye K.G., Braunschweig, manufacturers of **equipment for industrial and laboratory use.** Their range includes a conductivity indicator fitted with an electronic amplifier, which modulates and controls a thermionic indicator (' magic eye ') as a zero indicator. The electronic amplification and the use of an inertionless zero indicator is claimed to procure an increased responsiveness. The measuring range is 1 ohm to 1,000 megohms; measuring frequency 1,000 H.

It is stated that the apparatus can be used for conductivity tests of solutions of every kind as well as of more or less viscous gelatinous substances. In the cellulose industry it is used for process control; in the food industry for meat, fish and milk tests. The conductivity indicator is also useful for phenol determinations and for the analysis of boiler feedwater, for the estimation of anions, cations, organic bases and alkaloids and for the determination of reaction velocities.

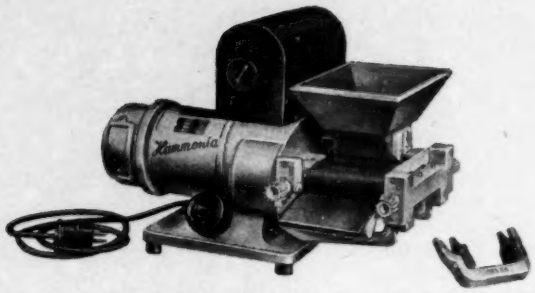
The firm also displays a *p*H meter,

stated to be suitable for redox measurements and for potentiometric titration. Applications include sugar refining and brewing, metallurgical and corrosion tests, electroplating, tanning and dyeing, photochemistry and the manufacture of explosives, ceramics, soap, lubricants, cosmetics, paints and varnishes, etc. A further exhibit will be a selector switch which enables up to six various measurements of *p*H and rH values to be carried out by means of the same *p*H-measuring kit. It thus replaces another five measuring units of the kind and is recommended for application wherever several measurements are required simultaneously.

Heinrich Flottmann GmbH., Herne. **Mixing device.** This firm are showing their *Flottmix* device for preparing cutting oils and similar liquid products which is claimed to have a number of advantages over other methods. One of these is that, by means of a control valve, the proportion of the two components, water and oil, can be regulated at will. A product can be produced whose proportions may vary between about 0.5 to 20 parts of oil to 100 parts of water. The makers state that the device is based on the principle that flowing water acts automatically through an injector-type mixing device as a suction agent for the oil to be added. This crude preliminary mixture will then be taken into a mixing apparatus in which the mixing of the oil and water is intensified until a homogeneous product is obtained.

Waldemar Harnish, Heidelberg, engage in the production of **filters** for all types of liquids and gases, based on the porous filter candle principle. The high-pressure gas filters have a capacity of up to 9,000 cu.m./hr. at pressures ranging from 6 to 25 atm. The vertical filters are easily cleaned without dismantling by opening a valve in the funnel-shaped base of the steel casing which surrounds the filter candle. The latter is resistant to corrosion, high temperatures and attack by chemicals.

Hermann Neuberg, Recklingshausen. **Heating systems.** Many modern plants have adopted the use of high-boiling, liquid, heat-transfer media such as diphyl, hydrocarbon oils or other materials. The company are exhibiting heating units for processes which consist of heater, circulating pump, thermostatic control and interconnecting pipework coupled to jacketed vessels. The heaters can be operated by means of fuel oil, gas, electricity or by utilising the waste heat from flue gases.



This ointment machine will appear on Josef Deckelmann's stand.

K. H. Schmidt, Wiesbaden. **Electric furnaces,** etc. The company will exhibit a number of their *Silex* electric furnaces which are constructed from highly refractory materials in accordance with the most recent technical advances. An efficient system of lagging reduces heat losses to a minimum and portions of the non-conductive hearth can be easily replaced without interruption of the process. The furnace is fitted with a series of switches and an ammeter so as to allow for the ageing of the silite heater elements. A built-in pyrometer gives readings up to 1,500°C. Some models are supplied with fully automatic devices which enable temperatures of up to 1,200 to 1°C. to be maintained for days or even weeks. The switchgear and controls are completely insulated and protected from the effect of heat. The fields of application cover dental ceramics, precious metals, jewelry, research and development work involving temperatures of up to 1,400°C.

Schmitz & Schulte, Burscheid. This company are exhibiting a representative range of their products including full-bore **valves,** diaphragm gate valves, steam traps, jointings of all kinds, piston rings, metallic and spring-loaded seals and rubber and plastic moulded goods. Items of particular interest include the AB-B1 steam trap, which is thermally controlled by means of an adjustable, broad, bi-metal, spiral strip which rotates the shaft of a valve progressively to provide an opening of sufficient size for the escape of an adequate volume of condensate. The strip is silver plated to avoid corrosion. The apparatus is claimed to have an exceptionally high capacity for its small size and weight.

The company are also showing their diaphragm glandless gate valves which are available in several sizes and materials to suit various types of liquids. *Teflon* gland packings and jointings are being exhibited and also a range of spiral, laminated, asbestos jointings and gaskets.

Schonebecker Brunnenfilter GmbH., Hannover. **Fittings** for water, gas, steam, oil and for the chemical industry. The company have recently extended their range of cast-iron and cast-steel fittings to include a new gate-valve, the SBF-M, a special feature of which is the free passage provided by the completely straight and circular bore. This is manufactured in light alloys for working pressures up to 142 p.s.i. and in cast iron for pressures up to 228 p.s.i. and temperatures of up to about 110°C. in each case. The field of application is very wide, as an elastic interchangeable sleeve can be selected to suit any medium which is to be used. The valve may therefore not only be used for water, air, foodstuffs, oils, petrol, etc., but also for a large number of acid and alkaline solutions.

Georg Schütz, Weisskirchen-am-Taunus. **Waxes.** This company will be displaying their range of mineral waxes for industrial use, including ozocerite (earthwax), a component of boot polishes and all kinds of wax polishes; montan wax in various forms; and synthetic hydrocarbon waxes.

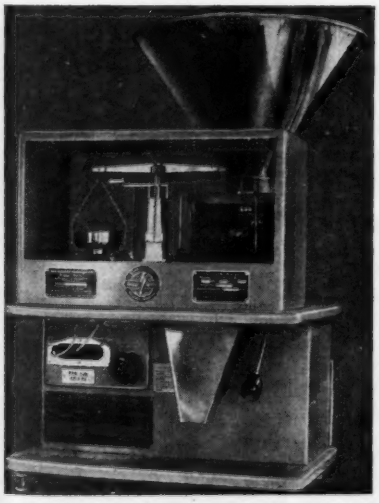
Dipl.-Ing. F. Siebrecht VDI, Bensheim. This stand will feature **dial thermometers** which have been specially developed for use in the chemical industry. They are based on the expansion of bi-metallic elements which are coupled to a pointer by means of a gearing mechanism. The makers point out that such systems have the advantage that they are not affected by secondary temperature effects, such as room temperature or radiation, and are more robust than glass apparatus. The upper temperature limit is 500°C., but they can be used for readings down to –90°C., which is considerably below the range of mercury thermometers. The instruments can be provided with suitable protection against corrosion, chemical attack and moisture. They can also be used in conjunction with

various forms of electric recording or regulating devices.

Vereinigte Armaturen GmbH., Mannheim. This company have developed some new designs of **valves**, as follows. The *Elita*, type G, is a space-saving type for mine service. The height of the valve is only about half that of the conventional sluice valve. Immunity from dust and other foreign substances is claimed, since its sealing faces never come into contact with the fluid. Only 10 spindle revolutions are needed to open or close the *Elita* valve N.D.10, compared with 36 for the normal type of sluice valve of the same diameter. The valve is made of spheroidal graphite cast iron.

Another valve, the *Hydro-Seal*, has been designed to replace hydraulically operated gate-valves or globe-valves of the common types. Its outstanding feature is the small overall dimensions. The closing operation is effected by a cylindrical, longitudinally folded diaphragm which is pressed against an egg-shaped internal guide-piece. The control or operating fluid—normally water—is supplied by a pumping plant in the same manner as for hydraulically operated gate-valves. Operation involves only a simple three-way cock for controlling the supply and discharge of the operating fluid.

The *Hydrostop* is a new non-return valve, offered as an alternative to check valves of the conventional and the improved types marketed in the last few years. The closing element incorporated in the *Hydrostop* is constituted by a longitudinally folded diaphragm of high flexibility. The special properties of the flexible diaphragm with regard to material and shape result in a high cushioning effect, thus avoiding water-hammer in the pipeline and the noise normally produced by swing check-valves.



Automatic weighing and filling machine (Fritz Collischan).

Stahlkontor Weser GmbH., Hameln, are showing a selection of **variable-speed gearing.** Units are available in six standard sizes for drives up to 7.5 h.p. and give infinitely variable speeds from 3,500 to 1 r.p.m. The gearing operates on the principle of the split vee pulley mounted on the primary driving shaft using a special broad vee belt. The two halves of the pulley are pressed against the belt by means of springs. Changes of speed are brought about by varying the distance between the axes of the driving and driven shafts. This is done either by displacing the position of the motor along its bed or by the rotation of a counter flange mounted on the driven shaft. The adjustment is carried out by hand or by means of a small electric motor, in which case speed variation can be effected by push-button control from a distance. The gears are supplied separately or in combination with a motor on a common baseplate.

C. A. Steinheil Söhne GmbH., München. **Precision engineering;** manufacture of **spectroscopes.** The universal spectrograph GH, with interchangeable optical equipment made of glass or quartz, has been available for many years. A new type of industrial spectrograph, which is built into the bench, has been developed. The visible spectrum can either be photographed, observed visually or its intensity measured photoelectrically. A simple projector in conjunction with a photometer (densitometer-projector) is used for the evaluation of the spectra, and a recently developed double projector (projector-comparator) serves for the comparison of two plates. A photoelectrical device for the recording of raman spectra is also being exhibited.

Heinrich Wenigmann, Haan, are exhibiting worm-type **plastics extruders.** These machines are characterised by their adaptability for processing a wide range of materials and for many different types of operation, such as the insulation of cables and the production of tubing, strip and profiles. The drive is by a motor mounted in the base through an infinitely variable gear. The barrel is heated electrically by means of a jacket containing a liquid heat-transfer medium and the desired temperature can be accurately controlled at a number of points by instruments mounted in the base of the machine. The temperature of the die can also be controlled independently. Automatic lubrication is provided by an oil pump. The output of the machines varies from 3 to 35 kg./hr. according to their size and the nature of the plastic.

New Trends in Plant Design at the Achema XI

(*Concluded from page* 129)

which are simple and cheap. The manufacturers of electrical instruments try to meet this demand; they will be prominent at the Achema XI and will display an overwhelming variety of devices.

It is a consequence of continuous production that much of the work connected with control of processes, which was formerly carried out in the chemical laboratory, is now performed by electrical or electronic instruments, and the laboratory has therefore to undergo some important changes. It will no longer be used to follow the course of the production. This branch of laboratory work has disappeared or will disappear. Of course, the chemical laboratory will still be needed; indeed, where research is concerned its importance will even increase. But the instruments used for that purpose, too, will change. Spectrometers, flame photometers and photo-electric spectrophotometers show the way to shorten the time necessary for an analysis. Optical methods are brought to a high degree of exactness by electrical measurements. Even the elementary analysis of organic substances can be done automatically, using electric heating. The analytical balances are on the way to automation, too; the tendency is shown by rather a large number of new designs. About 10 firms will show their devices in this field; five firms will exhibit semi-micro-balances, four firms will show balances with projection reading scales and the same number will exhibit fully automatic balances. Nearly 150 firms will exhibit laboratory equipment. A feature of special interest is the steadily increasing number of devices used in the chemical plant brought down to the dimensions of the laboratory; for example, centrifuges making 15,000 r.p.m., working so silently that they really do not disturb the work in the laboratory (Phywe A.G.). Other centrifuges even reach 40,000 r.p.m. (Carl Padberg).

The difficulties involved in the departure from batch production are the greatest on the production line itself. Indeed, it would be easier to build up a new plant fully automatised. It is often much more difficult to change from batch to continuous production with plant of a specific kind and dimension. Weighing, for example, is in many plants an intermittent process which must be eliminated to achieve automation. Filtering is another operation which is prevailingly intermittent, but a considerable number of the 34 firms exhibiting filters at the Achema XI have been successful in designs for transforming it into a continuous process. There are six manufacturers from abroad showing filters at the Achema XI.

Heating is always an important item for the chemical industry and for economic considerations it is increasingly important to use heat in the most effective way by the application of heat exchangers. But who would think that there would be more than 40 German firms offering their designs of heat exchangers?

Those firms which are on the way to automation will find what they are looking for. There is no doubt about that: the dimensions which are necessary for running an automatic chemical plant economically are diminishing from year to year. More and more medium-sized chemical plants will take automation into consideration. And it will be necessary for them to do so, otherwise competitors erecting new plants will reap the advantage of having modern installations initially.

Josef Hausen, DR. PHIL. NAT.

ACHEMA YEAR BOOK

The 'Achema Year Book, 1953-55, and European Catalogue of Chemical Apparatus and Equipment' is an impressive volume of some 900 pages. It is trilingual (English, French and German) and not only enables visitors to the Achema Exhibition and Congress to prepare themselves in advance, but also has a more permanent use as a work of reference.

The presidents of 19 scientific and technical societies have contributed forewords, while another section contains reports by 26 European technical universities on their work in the chemical apparatus and equipment field. Some 92 firms have contributed articles describing their latest developments, and a further section, the Buyer's Guide, gives the names and addresses of 819 firms, from 13 countries, who supply chemical plant, instruments, etc. The Index (376 pages) answers such questions as 'Who can supply?' and 'Who can give information on?' and mentions 6,000 items of apparatus and products. This section could also serve as a trilingual vocabulary. The Index of Trade Names is also trilingual.

Published by Dechema—Deutsche Gesellschaft fur chemisches Apparatewesen—the book is issued free of charge to those who register for the Achema XI Exhibition and Congress. If copies are still available after this event, they will be issued to non-visitors.

Data on Engineering Materials

Over a period of 20 years the authors have systematically collected data which would be helpful to the chemist or engineer in the choice and use of engineering materials. On this basis they have compiled this guide,* a standard work of inestimable value which, though it can be compared with the American 'Corrosion Data Survey,' is far more extensive, embracing as it does almost 100 engineering materials and some 900 chemicals as compared with the 25 to 30 engineering materials and 500 chemical agents of the American publication. It must also be borne in mind that these chemical tables will never be out of date. This truly monumental work is on loose leaf, 100 sheets being sent out at a time. New discoveries and experiences can therefore be added easily either on additional sheets or by revising one or another of the tables already published.

The purpose of this publication is to collect the widespread experiences and knowledge of possible uses of engineering materials and to present these clearly and precisely. The method adopted has been dictated by the amount of material. Space saving and clarity are maintained, since each chemical and each engineering material are given a separate page. This compilation is made up of two sections:

(*a*) Pages giving physical properties include about 95 engineering materials; however, none of these pages has appeared at the time of this review.

(*b*) Pages concerned with chemical resistance, in which data relating to the action of over 850 chemical agents on these engineering materials are set out.

A separate page is devoted to each chemical and they are arranged alphabetically. The front of the page is given over to the actual table, the back to 'Notes and Remarks.' If necessary, as for example in the case of ethyl alcohol, these are extended to another page. The engineering materials are subdivided into three groups:

(1) metals and alloys;
(2) non-metallic inorganic materials; and
(3) mainly organic engineering materials.

The chemical agents are given in English and French as well as in German, but it is to be hoped that the explanatory directions for the use of these tables, now given only in German, will also be issued in the other two languages, thus greatly increasing the value of the tables.

The first hundred or so pages to be issued cover chemical agents from abietic acid to ammonium sulphite. A few chemicals are mentioned without as yet any details. Space is provided for them, the tables to be issued at a later date.

The second and third sections are an excellent continuation of the first part.

They are again in alphabetical order and comprehend all chemical reagents from aethylenharnstoff (ethylene urea) to benzilsäure (benzilic acid) and benzin (petrol) to 1, 3 butadiene. However, in some instances, there is more detail.

Whilst it is the rule that the remarks for each chemical reagent fill only the back page of the table, there are, for example, six pages on the atmosphere (air), two pages for ammonium chloride, four pages for ammonia and two pages for ammonium sulphate. A pleasing feature is that, although a variety of materials (for instance 'Pure Oxide Ceramics') have to be classed together in the table, they are considered separately in the notes where necessary. For example, it is mentioned that $BaSO_4$ does not wet *sinteralumina* at even 1,650°C.

It is in fact an excellent work which deserves a very wide use. The compilation has been carried out with the greatest care and should prove a useful reference in laboratory and workshop. The publishers and the two compilers, Rabald and Bretschneider, are to be congratulated on their work. May the future sections be equally useful.

FELIX SINGER

**Dechema-Werkstoff-Tabelle* (Dechema Tables of Engineering Materials) by E. Rabald and H. Bretschneider. 3rd edition, Parts 1, 2 and 3. Chemie GmbH., Weinheim, 1954.

New Paths in SMOKELESS FUEL PRODUCTION

By W. Idris Jones, C.B.E., B.SC., PH.D.
(Director General of Research, National Coal Board)

A new method of producing smokeless fuels from low-rank coals has been brought to the pilot-plant stage at the Stoke Orchard research establishment of the National Coal Board. The process involves the oxidation of coal by the fluid-bed technique developed for catalytic oil cracking. Very high by-product yields are obtained. There are three stages in the new method, fluidised carbonisation being followed by briquetting at elevated temperatures and then a second carbonising stage in which hot sand is used as the heating medium. The new process was described by Dr. Idris Jones during a recent address to the Royal Society of Arts, part of which is reproduced below.

COAL is not only our primary source of heat and power but also an essential factor in the production of metallurgical coke, chemicals, plastics, textiles, etc. The demand for these products is increasing and it is important to enquire as to the part coal will play as a raw material in the future, more particularly in view of the role of petroleum oil as a source of energy, of gas and of chemicals. More attention is being directed to the problem of smokeless fuel production to improve the state of the atmosphere notably in our large and industrial cities and towns, as is evidenced by the recent Air Pollution Committee report. Another factor of importance is that high-volatile non-caking or weakly caking coals constitute the major proportion of our coal reserves.

Various methods of coal treatment such as thermal decomposition, oxidation, hydrogenation, gasification and hydrocarbon synthesis have been tried with varying success in the past. We are concentrating at Stoke Orchard on the thermal treatment of coal, hydrogenation and synthesis being economically unattractive on current United Kingdom prices and gasification being regarded as the primary responsibility of the Gas Council.

Hitherto both H.T.C. and L.T.C. of coal have been used extensively, the first mainly for the production of hard metallurgical cokes and the second for reactive smokeless domestic fuels. Features of these processes are set out in Table 1.

Both processes require coking coals and these are becoming scarce and expensive to mine. The demand for hard coke and solid smokeless fuel is also increasing. To what extent, therefore, can we make good and better quality hard cokes by scientific blending of the weakly caking coals with the best coking coals and by improved processing of the second-grade coking coals? Can we process low-rank coals in such a way that they will serve all the purposes we now associate with high-rank coals and give high-quality hard cokes and also reactive cokes? How, too, can we reduce the capital costs of carbonising plant and reduce the heat losses characteristic of these plants? These are important questions that we are endeavouring to answer at Stoke Orchard.

Hard coke production

The work at Stoke Orchard aims at using a wider range of coals for classical coke production and at evolving new types of hard cokes. Attention is being concentrated on the fundamental aspects.

It is well known that some coals pass through a fluid or plastic state when heated and the work at Stoke Orchard has shown that there is a direct relationship between this fluidity and the hardness of the coke (Fig. 1). It also appears that a certain optimum viscosity must be achieved before a satisfactory coke will result (Table 2).

If a sample of coal is heated very rapidly to about 400°C. and thereafter maintained at a constant temperature, the viscosity increases at a steady rate, due to a steady increase in the amount of semi-coke. Using this increase in viscosity as a measure of the increase in the amount of semi-coke, the reaction velocities and the activation energy, as derived from the Arrhenius equation, have been calculated for a number of coals. The results agree closely with similar figures calculated by Van Krevelen, who measured the volatile matter emission, and show that the activation energy involved is

Table 1. Features of H.T.C. and L.T.C. Coal Treatment Processes

	H.T.C.	*L.T.C.*
Coke yield, cwt./ton coal	13.5	15.0
Coke reactivity (CAB, cu.ft./min.) ..	Up to 0.08	Ca. 0.04
Tar yield, gal./ton coal	Aromatic	Paraffinic-naphthenic-aromatic
Tar production in 1953	2.75 million tons	8 million gal.
Crude spirit yield, gal./ton coal	Ca. 2.0	2.5 to 3.5
Crude spirit production in 1953 ..	106 million gal.	1.5 million gal.
Gas, cu.ft./ton coal	Up to 12,500	Up to 4,500

Table 2. Variation of Coke Strength with Viscosity

Composition		*Volatile matter*	*Minimum viscosity*	*1½ in. shatter index*
% A	*% B*	*% d.a.f.*	*(poises)*	
100	—	—	5,500	79
75	25	—	39,300	84
50	50	34.9	71,000	84
50	50	34.1	444,000	84
50	50	33.4	835,000	77
50	50	34.1	1,510,000	71

approximately 50 Kcal./mol. (Table 3). This is about the same value as that quoted for breaking the C-C bond in the cracking of mineral oil. In the case of coal, the reaction possibly involves the separation of a complex attached to the periphery of the graphite-like layer structure.

Work at Stoke Orchard has shown also how low- and high-rank coals when suitably blended yield cokes of increased reactivity. Similar effects are obtained when an oxidised second-grade coking coal is blended with the unoxidised coal. The improved combustion characteristics are linked with the more open, unfused nature of the blends containing low-rank coals and other factors. Following this work at Stoke Orchard, full-scale trials, using blends of high- and low-rank coals and using high and medium flue temperatures, are now in progress in the divisions of the Board.

In all oven coke production the products must be of a uniform size, and this has led us to a study of crack formation in coke with a view to controlling this factor. Cracks are formed in coke during and after the period when the material in the oven is changing from a plastic mass to a brittle solid.

The temperature gradients result in the presence of shrinkage gradients extending throughout the mass. An electrical heat-flow analogue has been constructed to facilitate the determination of the temperature gradients and heat changes taking place in the ovens. Further light has been thrown by this work on the endothermic and subsequent exothermic changes occurring during the coking of coal (Fig. 2).

Table 3

Coal	*Coal rank Code No.*	*Dry ash-free volatile matter (%)*	*Agglutinating value B.S.I.*	*Temperature range over which E is determined (°C.)*	*E (Kcal./mol.)*	*Reaction velocity at 420°C. (1/min.)*
1	2	3	4	5	6	7
Maritime ..	301	24.7	27	419 to 448	52.7	0.033
Manvers ..	502	37.2	27	394 to 416	48.2	0.124
Blackwell (blend)	602/401	37.7	20	402 to 422	54.2	0.161
Grassmoor ..	702	40.0	17	405 to 426	47.3	0.175
New Stubbin ..	401*b*	35.1	29	397 to 417	47.5	0.135
Parkgate 6 ..	502	38.5	29	408 to 441	47.6	0.114
Thurcroft ..	401	36.1	24	411 to 442	52.2	0.097
Union	401	31.5	29	419 to 435	46.7	0.048
Winning ..	602	39.6	24	414 to 429	55.0	0.174
Winning Durham (blend) ..	602/401	37.4	28	410 to 429	54.6	0.119

New processes of coal treatment

Many of the coals from which smokeless fuels and metallurgical coke will have to be made cannot be converted direct into these products, but our research has shown that they can be pretreated and briquetted and the briquettes then carbonised. The *Phurnacite* process developed in South Wales is a process of this type, but the coal used does not require pretreatment, being of the non-caking high-rank type. Work is in progress to extend the range of suitable coals, of which the nearest are the South Wales, Scotland and Kent coals (volatiles up to about 18%). When these are briquetted with pitch and the briquettes carbonised, they swell, stick together in clusters or even flow into a solid mass. This is due to the exessive agglutinating value of the coal. Research has shown that the agglutination or fluidity can be reduced or destroyed by a relatively mild pre-oxidation of the coal. We first developed a process involving the use of a rotary retort, but subsequently a new process involving the oxidation of coal by the fluid-bed technique, developed for catalytic oil cracking, has been brought to a pilot-plant stage at Stoke Orchard, treating 1 ton/hr. of coal. It is hoped that this process will be in a state which will permit consideration in the near future of possible translation on to the large scale.

The coals which react well to oxidation and subsequent briquetting and carbonising are limited in number and the product is a closed appliance fuel. But there is a great need for reactive open-grate fuels also and the main source are the low-rank, non-caking or feebly caking coals. Processes exist which can convert such coals into smokeless fuels, but they demand either that the coal be in lump form or involve the use of complicated machinery operating at relatively high temperatures. Moreover, they are either discontinuous or require the use

Fig. 1. *Below:* **The effect of blending on coal viscosity and coke hardness.**

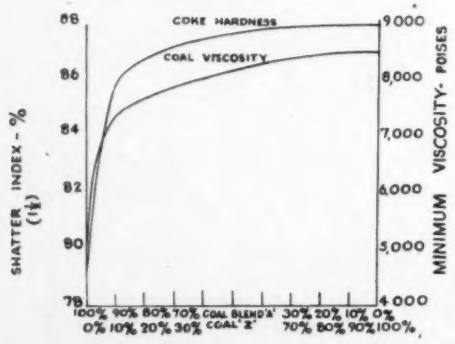
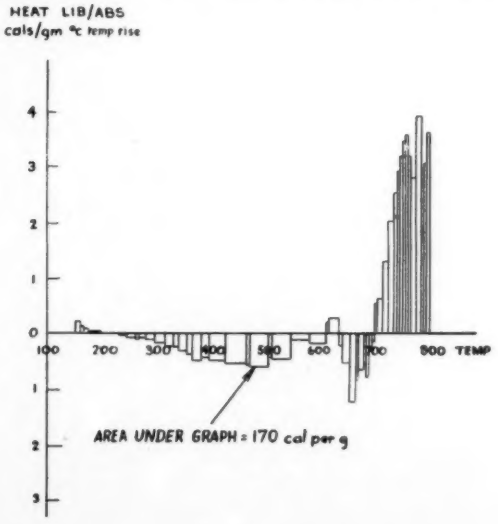
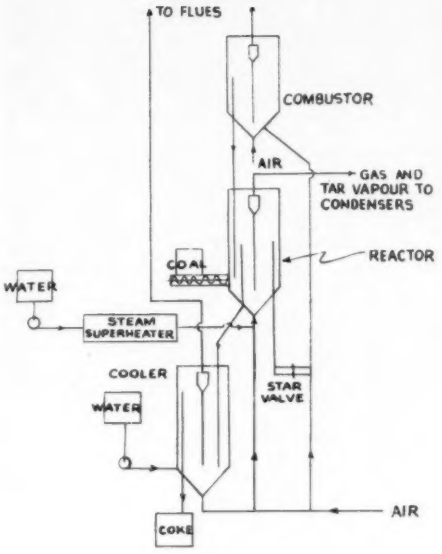


Fig. 2. *Right:* **Heat of reaction during carbonisation in cal./g./°C. plotted as a function of temperature in °C. for Dinnington coal.**





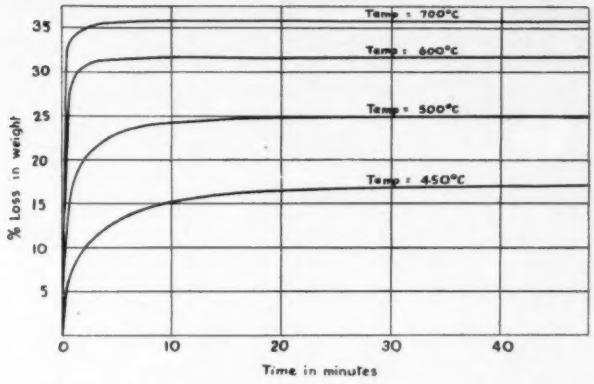


Fig. 3. *Left:* **Diagram of oxidation plant.**

Fig. 4. *Above:* **Carbonisation of low-rank coals: loss in weight/time.**

of numerous small repetitive units. Modern chemical engineering methods tend towards the single units with high throughputs per unit of reactor volume and research has therefore been directed in the first place to fluidised carbonisation. Various methods of supplying the heat rapidly to the fluid bed have been tried and one involving partial combustion of some of the product char in another fluidised bed would appear to make best use of the favourable properties of fluidised beds, that is rapid mixing and heat transfer and absence of temperature gradients (Fig. 3).

Owing to the small size of the coal particles being heated and the uniform temperature of the bed, the by-products are evolved rapidly and suffer very little cracking and polymerisation. Very high yields are therefore obtained and, on the basis of current results at Stoke Orchard, Table 4 sets out the yields, etc., which might be expected at a hypothetical plant treating 3 million tons p.a. of coal.

Table 4. By-Product Yields by Fluidised Carbonisation

On basis of 3 million tons/yr. coal carbonised:	
Total tar.. ..	82,000,000 gal.
Liquor	33,000,000 „
Tar composition	
Light oil.. ..	8,000,000 „
Intermediate oil..	8,600,000 „
Pitch creosote fuel oil	60,000,000 „
Low boiling tar acids	5,400,000 „
Gas	12,000,000,000 S.C.F.

While much of our effort is directed towards the technical aspects of this process, the more fundamental aspects are not being overlooked. Investigations have shown that, while minor variations occur between different low-rank coals when heated in the range 400 to 650°C., their rates of decomposition show a remarkable similarity, suggesting that the basic carbonisation reactions are the same. The loss in weight is virtually complete after 30 min. at 400°C., while at 650°C. five minutes is sufficient (Fig. 4).

Two main reactions appear to be involved, one being ten times faster than the other, and contributing about 70 to 80% to the total loss in weight. The faster reaction would appear to be concerned with tar formation and the slower reaction with gas formation; this offers interesting possibilities of controlling the gas yield without appreciably decreasing the tar yield.

The product from the fluidised carbonisation reactor is a powdered char or semi-coke, and as such it would be quite useless as a domestic fuel. It has therefore to be briquetted or agglomerated. It has no agglutinating value and, being highly porous, it would require up to 20% of pitch, which is quite uneconomic. The char leaves the carboniser at a temperature exceeding 500°C., and to cool it down for briquetting and heat the briquettes up again for carbonising would be wasteful of heat. Attention has therefore been paid to briquetting at elevated temperatures, using a mixture of pitch and fusible coal as binder. The pitch in this case acts as a flux and extends the range of temperature over which the binder will remain fluid and therefore in a condition to wet the char surface and penetrate the pores. This process has been tried successfully on the small scale at Stoke Orchard (Fig. 5).

The two stages of the process so far described, fluidisation and briquetting, are capable of expansion to high and continuous throughputs. We are therefore endeavouring to evolve a

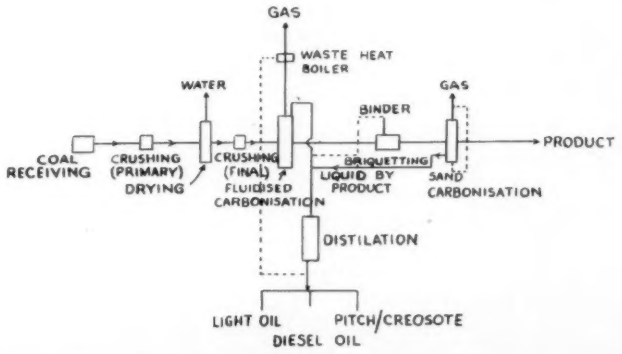


Fig. 5. General flow diagram.

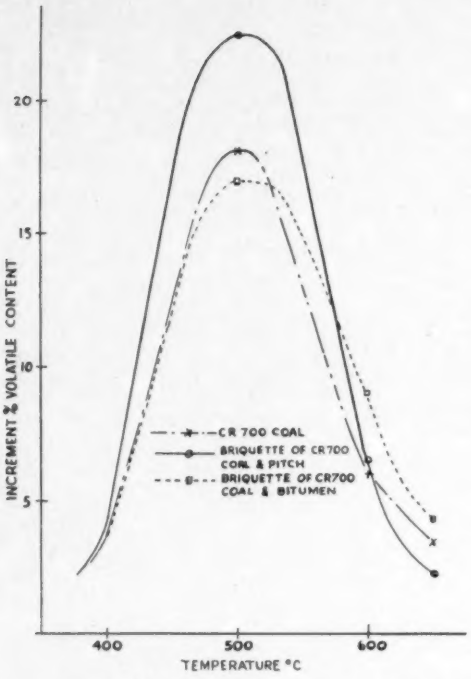


Fig. 6. Volatile emission characteristics of a C.R. 700 coal with pitch and bitumen.

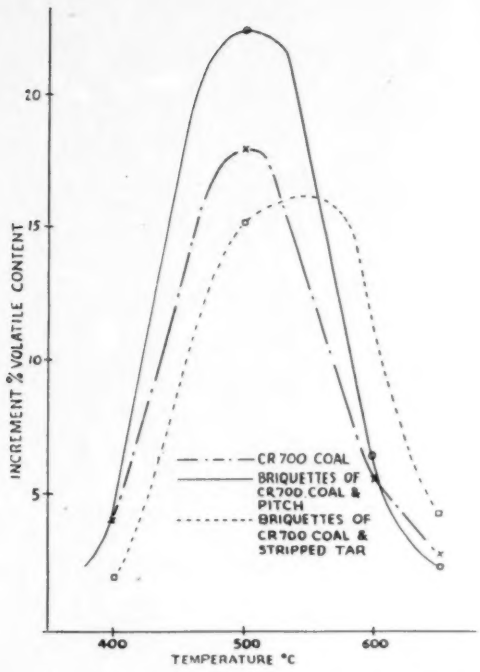


Fig. 8. Volatile emission characteristics of a C.R. 700 coal with pitch and stripped tar.

second carbonising stage for carbonising the briquettes in keeping with these and have found that it is possible to reduce the residence time to about 30 to 45 min., which compared with 4¼ hr. in the conventional indirectly heated *Phurnacite* retorts. One way of achieving this is to use hot sand in a fluid or mobile bed as the heating medium. This sand process is now being extended to a larger scale at Stoke Orchard.

The three-stage process (fluid carbonisation → hot briquetting → fluid carbonisation) which I have described still has a long way to go before we can be certain of its reliability and economics. We are therefore working on alternative processes using conventional plant. A study of the volatile emission curves of coal and some binders shows that the peak for a bitumen-bound briquette is at the same temperature as that for the coal, though it extends over a wider range (Fig. 6).

In the case of pitch the peaks do not coincide, but if certain chemicals are mixed with the pitch beforehand, the volatile emission curve is reduced and widened in a manner similar to that of bitumen (Fig. 7).

A soft pitch made by stripping the low-boiling material from the tar produced by carbonising the coal again has the effect of lowering the peak of volatile emission and broadening the temperature range over which volatiles are given off (Fig. 8).

Work has shown that briquettes made with the aid of these modified binders can be carbonised without distortion or fusion. This opens the way to immediate development to yield a closed appliance fuel.

It would obviously be a great advantage if the briquetting stage in these various processes could be carried out without using a binder at all, and recent work at Stoke Orchard, based on a concept of Rhys Jones and R. Gregory, has shown that this can be done without resorting to the enormous pressures used hitherto in Germany and elsewhere for brown coal. The resulting briquettes are very strong and those made from the low-rank feebly caking coals on carbonisation yield products of even greater strength. The possibilities of this process in conjunction with the other techniques I have described are considerable; conjointly they would appear to be capable in due course of solving the problems of limited availability of large coal and of coking coal for the production of metallurgical coke and smokeless fuels.

Considerable effort is being put into all this work at Stoke Orchard and the results have shown that it is possible to

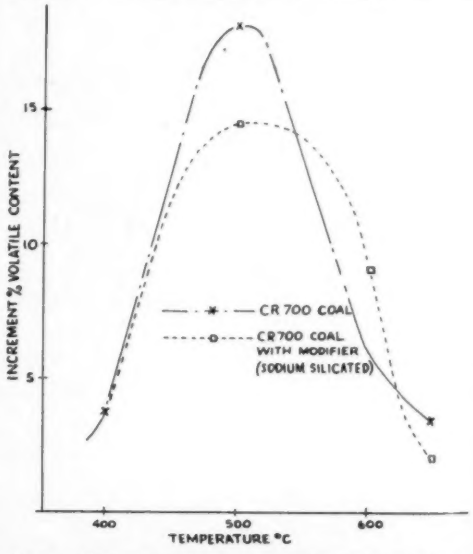


Fig. 7. Volatile emission characteristics of a C.R. 700 coal with a modifier.

a marked degree to control the yields and types of solid, liquid and gaseous products resulting from coal pyrolysis and to produce ' tailor-made ' smokeless fuel for open or closed domestic appliances and metallurgical cokes, from low-rank coals.

A possible application of fluidised carbonisation also is in the pretreatment of coals for pulverised fuel boilers, the char being fed to the boilers and the tar, gas and liquor treated separately.

Letters to the Editor

Wooden Vessels in the Chemical Industry

TO THE EDITOR:

SIR.—I was very interested in reading the article by W. T. Colyer in your February issue. Two statements are open to question, the first being about lignum vitae, where it is stated that the size range of outlet taps is rather limited, ' as it does not exceed 1-in. diameter bore.' Is one to understand that the normal outlet tap cannot be made larger than 1 in., or is Mr. Colyer referring to the wood?

If the latter is the case, I would hasten to say that we carry large stocks of this wood, and 10-in. or 12-in. diameter is a normal size. There is no reason why lignum vitae outlet taps could not be made within the limits of such logs.

The second point is on the subject of seasoning, where it is stated that timber in thicknesses of 2 to 4 in. does not lend itself to kiln drying which in any case is ' unsatisfactory for other reasons.' In this case again I must disagree with Mr. Colyer as, with very few exceptions, there is no difficulty whatever, apart from that of time, in kiln drying such thicknesses. As regards the latter part of the above quotation, perhaps Mr. Colyer is referring to the old days of some 25 years ago before scientific control of kiln drying was introduced and severe stresses were set up in timber which later misbehaved itself to the embarrassment of the user. Today proper schedules are laid down and most timbers can be kiln dried satisfactorily without degrade and, in fact, kiln drying is really necessary for indoor use, as unassisted air seasoning cannot bring the timber down below about 14% moisture content.

In centrally heated buildings where one will find an ambient moisture content of 9 or 10%, one can imagine the state of floors which would shrink .16 in. per foot width if thoroughly ' air-seasoned ' wood had been used. This merely following a drop in moisture content of 4%.

D. B. IRVIN,
Managing Director,
Irvin & Sellers Ltd.,
Liverpool 20.

Mr. W. T. Colyer replies:

I welcome Mr. Irvin's letter, as it enables several points to be clarified.

I know lignum vitae is available in the sizes he mentions and we, in fact, stock it in these sizes for making toe-step bearings for stirrers. It is, however, another matter to obtain lignum vitae in large sizes in the flawless quality required for tap-making. Our suppliers have always complained of the difficulty of this. If Mr. Irvin can name a firm making lignum taps in sizes above 1-in. bore it would be of great interest not only to us but doubtless to many readers of this correspondence.

Regarding kiln drying, when I said that thicknesses of 2 to 4 in. do not lend themselves to kiln drying, perhaps I should have added ' as readily as thinner substances.' I know that the technique of kiln drying has made great advances in recent years and many former difficulties have been surmounted.

The remainder of Mr. Irvin's comments are mostly devoted to showing how necessary it is to have kiln-dried timber for joinery work in heated buildings. I agree with this, of course, but vat-making is a very different proposition. The essential requirement of timber in vats is that it shall resist penetration by various liquids. We find by experience that when timber has been kiln dried its resistance to this penetration is lowered. Furthermore, in cases of timbers which are naturally somewhat vulnerable to rot under wet conditions, such as Columbian pine, this vulnerability is perceptibly increased by kiln drying. Some timber is imported already kiln dried and we have learnt by experience to avoid it as far as possible.

Sasol oil-from-coal works

The plant for producing petrol and a wide range of chemical by-products, referred to on page 32 of our January 1955 issue, should have been referred to as the Ruhrchemie-Lurgi plant, for which omission we offer our apologies to Messrs. Ruhrchemie A.G.

Russia's New Caustic Soda Process

Two Russian chemists, V. M. Kakabadze and T. A. Ivanova, have developed a new process for the manufacture of caustic soda solution which, according to *Chemiker Zeitung*, is likely to become a serious competitor of the two methods which are in general use at present: the caustification of sodium carbonate and the electrolysis of brine.

The raw material used for the new process is sodium sulphate. This is first reduced to sodium sulphide by one of the usual methods, *e.g.* by mixing it with powdered coal or coke, heating the mixture to 800°C. and extracting the sulphide with hot water:

$$Na_2SO_4 + 4C = Na_2S + 4CO$$

The sulphide solution is then made to react with manganese dioxide at a temperature between 18 and 25°C. according to the equation:

$$Na_2S + MnO_2 + H_2O = 2NaOH + MnO + S$$

As the equation shows, the presence of water is essential. The best yield was obtained by the Russian chemists when they started with a sodium sulphide concentration of 11.5 to 12% and used a very finely powdered manganese dioxide. It is not necessary to use pure manganese dioxide. Any pyrolusite of high MnO_2 content will do, if finely powdered. The solution obtained in this way contains 117 to 120 g. of NaOH per litre.

Boiler feed tank installations are the subject of the latest information sheet, No. 14, issued by Spirax-Sarco Ltd. More than a dozen practical points, most of them illustrated, are dealt with. The information, given concisely, includes recommendations on feed tank capacity; on tank heights to facilitate pumping; feed pump exhaust recovery; the avoidance of undue back pressure on the condensate return system due to the lift to a high-level tank; the proper conservation and use of flash steam; make-up water arrangements; the lagging of feed tanks; and other aspects. Other information sheets in the same series, at present available, are on ' The Sizing of Steam Pipes,' ' The Sizing of Condensate Return Mains,' ' The Calculation of Condensation Rates,' 'Air in Steam Spaces,' ' Oil Fuel Installations,' ' Diesel Engine Automatic Cooling Control ' and ' The Automatic Control of Accelerated Hot-Water Heating Systems According to outdoor Temperature Changes.'

Welding in the Maintenance and Repair of Chemical Plant

By C. W. Brett, M.INST.W.
(Managing Director, Barimar Ltd.)

THE chemical and related industries have been quick to realise the advantages that welding offers for the fabrication of new plant, but they have been somewhat slower in exploiting the same fundamental processes for purposes of maintenance and repair. This is an entirely separate branch of work and one that requires an uncommonly high standard of skill, both in the treatment of steel components by electrical means and in gas welding, which is more usually applied to cast and malleable iron, together with non-ferrous metals.

It should be pointed out here that dealing with cracks and fractures, while most important, forms only a small part of this work. An aspect that is too often overlooked is the substantial improvement that can be imparted to a welded item, whether it be a heavily loaded moving part or an autoclave. This is because it is not merely a matter of increasing strength in many instances, but of staying the inroads of corrosion and wear as well.

Trouble arising from these causes can be expensive, reckoned not only in terms of replacement but also in delays arising from having important items of plant out of commission. To meet this need, scientific welding can be done with great speed and, if necessary, on the site at emergency tempo. However, where the services of welding specialists are engaged, it is more usual for the faulty parts to be sent to them. In this case the work is generally completed within 24 hr. of its being received, even if machining is necessary, for a comprehensively equipped machine shop is a necessary auxiliary to all welding firms of repute.

Another aspect of this work that is not generally appreciated is the degree of skill involved. Although, to the uninitiated, welding appears a simple matter, it is in fact quite complex. Years of careful training go to the making of a dependable operator, who must, in addition, be provided with a surprising variety of modern equipment. To achieve strength is an elementary matter, compared with the maintenance of true alignment for which the standard tolerance is no more than one-thousandth part of an inch. The certainty with which accuracy can be obtained is demonstrated by the large number of crankshafts that are reunited after suffering fracture plus the added complication of distortion.

Obviously inspection must be unusually searching, therefore it is largely carried out by radiographic methods of scanning which allow the entire weld to be examined in depth, the quality of the metal to be verified and the degree of penetration into the parent metal fully examined.

'Invisible mending' of chemical plant

Turning from these generalities to more specific work, striking progress has been made in the repair and maintenance of various types of plant for which stainless steel is employed. New equipment embodying this material is inevitably expensive, but welding makes it possible to recondition older but still valuable items of plant, bringing them up to modern standards. Many pressure containers and the like which have suffered severe corrosion have been relined entirely with stainless steel. This is applied in strips butt-welded in position so that, when all is finished, there is no visible trace of the joins. In some instances it may be preferable to use different materials such as Monel metal, for any alloy can be handled, including those which have such a high content of magnesium that they are highly inflammable in small fragments.

Compressors of various classes are welded from time to time. Jackets may be severely fractured and in some instances the bores are also involved. Where sections are missing entirely, new pieces can be made up and welded in position. This also can be done so as to leave no visible trace of the work that has been done.

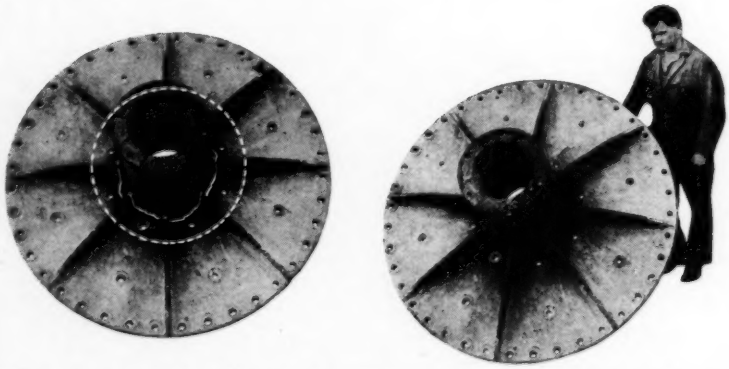
Pumps of various types are very often in need of repair by scientific welding methods. If they are of centrifugal design and a rotor needs to be built up afresh it can not only be effectively repaired but also perfectly balanced.

Good welding is always permanent and should never be regarded as a temporary measure, designed merely to bridge an emergency.

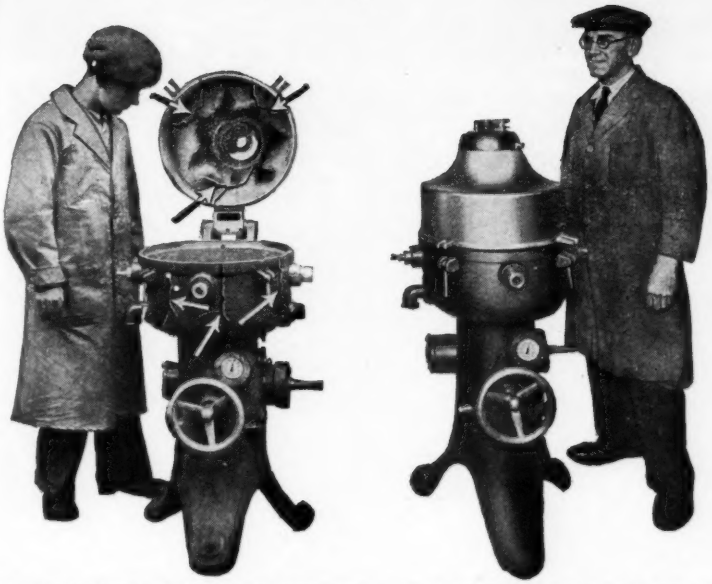
Too often these days one still sees riveted patches applied to boilers and other vessels. Such obsolete methods are inefficient as well as unsightly, largely because ledges are created wherever there are lap joints. In contrast, welding alone permits a butt joint of great strength.

Modern welding techniques

At one time it seemed almost impossible to avoid tiny pit marks when



Left: **Cast steel trunnion plate of tube mill. This formed the end cover of a large revolving cylinder and it had to carry the great weight of the material being pulverised in the mill.** *Right:* **To make the end plate strong enough for the heavy load, in addition to the repair of the cracks by scientific welding, extra metal was welded around the radius of the trunnion.**



Left: **Badly damaged high-speed separator. The body was made of cast iron and the cover of aluminium. Both were extensively cracked.** *Right:* **All the damage was successfully repaired by scientific welding, at a great saving on the cost of replacement. When repaired, the cover was a perfect fit.**

welding steel. These were caused by the affinity of the oxygen in the atmosphere for the molten metal. The problem has been solved by enveloping the weld in a pocket of inert gas, usually hydrogen, in order to prevent contact with the surrounding air when the metal is in a molten condition. Usually the requisite barrier of gas is provided by a chemical compound with which welding rods can be coated, but sometimes the supply is obtained from a high-pressure cylinder.

Chemical engineering is an industry in which specialised equipment is required from time to time, units being produced individually for a specific class of production. The construction of a possibly unique item of plant can be costly, particularly if castings are involved that require complex patterns which may be needed only once. Flame-cut steel plate fabricated by welding can reduce the cost materially and at the same time increase the strength and lower the weight. Pipework, too, can be handled effectively by welding in continuous lengths instead of fitting unions and joints. If replacement becomes necessary, then the pipe is cut and a new section welded in position, thus relieving any anxiety that might arise from a leaking joint.

The spraying of metal, whilst not a welding process in the normal meaning of the description, is nevertheless one of considerable value to the chemical industry, for it permits of a pure metallic coating being given to any matt surface which need not be metal, for there is no tendency to burn or even scorch. Either a powder or wire of the metal to be applied is passed through an oxy-acetylene flame and the molten particles, which are formed instantly, are ejected by a jet of compressed air from the spray gun which, externally, closely resembles a paint spray. Beneficial results have been obtained in many ways; for example, zinc has been found to have remarkable deodorising qualities, whilst the spraying of aluminium on the interior surfaces of boiler furnaces has advantages that are widely appreciated.

Whenever corrosive materials must be handled and high temperatures are inevitable, then maintenance needs are apt to be particularly insistent. Any reduction of cost in this direction is a valuable aid in lowering the price of the product. Still more important is the necessity for uniformity in the material produced and, here again, attention paid toward maintaining plant in the best possible conditions pays dividends. Toward this end there is no method which compares with the speed, trustworthiness and low cost of scientific welding.

FORTHCOMING ARTICLES

Hydraulic Transportation of Coal; Review of Fractional Distillation; Relaxation Methods in Heat Transfer.

Recent Publications

Distillation plates. The A.P.V. 'West' distillation plate has seen several modifications and developments since the original designs, combining some features of the perforated plate and bubble-cap tray, were developed. In particular, states a new brochure from the A.P.V. Co. Ltd., there is now available an arrangement which exhibits an exceptionally low pressure drop and has other marked advantages. The 20-page brochure goes on to describe the principle of the 'West' plate and to deal with the various features, discussing stability and flexibility, plate efficiency and entrainment, plate spacing, capacity and pressure drop. In addition to diagrams and photographs showing various aspects of the distillation plate, there are some photographs of typical installations.

Electronic switchgear. We have received four leaflets from a new series, descriptive of a range of devices manufactured by Electronic Switchgear (London) Ltd. The standard range includes controls for the following: liquid level; level of divided abrasive solids and granular materials in bunkers, hoppers and silos; time; flame failure safety in gas- and oil-burning furnaces; water hardness; temperature; conveyor control; packaging; high- and low-speed photoelectric counting and batching; resistance and induction heating; smoke indication; automatic door opening; refluxing in fraction distillation; turbidity in liquids, etc.

Atomic models. New space-filling atomic models, incorporating elastically distortable valency angles as well as free rotation about single bonds, and allowing the use of bonds of adjustable length, are described in a 12-page illustrated leaflet from Griffin & Tatlock. The Courtauld atomic models are designed for use in research and education and are made on a scale (0.8 in. = 1 Ångström) large enough to allow of accurate quantitative work. Many molecules can be built, including those with strained rings, which cannot be constructed with a rigid linking mechanism.

Plastics moulding. Information sheet C.101 from British Resin Products Ltd. deals with *Cellomold* 630, 650 and 660 cellulose acetate moulding materials, which are available in five different flows: very soft, soft, medium, hard and very hard. Differences between the three series are explained and physical properties are tabulated.

Chemical Engineering Invention

RECENT BRITISH PATENT CLAIMS

Ball mill

In a process of vibratable grinding, the direction of oscillation of the mill is periodically reversed. In the case of an assymmetrical mill, the periods are of unequal duration. The ball mill, Fig. 1, is supported on springs 4

FIG. 1.

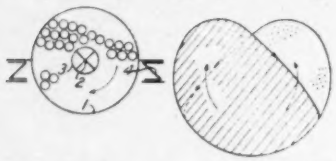


FIG. 4.

and driven by means of a shaft 2 in a protecting tube 3. The mill may have a heart-shaped upper surface as shown in Fig. 4.

During the interval while the direction of oscillation is reversed, the speed of the mill passes through its critical speed of oscillation, causing oscillation of large amplitude and violent impacts which loosen the material being ground.—696,001, *Naamlooze Vennootschap Tema.*

Chlorination processes

Hydrocarbons or their derivatives are chlorinated by means of gaseous chlorine, the chlorination being carried out in an aqueous emulsion. The process can be used for the substitution of hydrogen by chlorine or for the addition of chlorine at carbon-to-carbon double bonds.

Hydrocarbons containing chlorine or other substituents, for example a hydroxyl, carboxyl, carbonyl or nitro group, may be chlorinated by this process. Chlorination of substituted aromatic hydrocarbons results principally in chlorination in the *o*-position.

For the preparation of the emulsions, emulsifiers are preferably employed which are capable of emulsifying the hydrocarbons to be chlorinated in water without being affected by the chlorine. Suitable emulsifiers are the sulphonates of long-chain paraffin hydrocarbons produced by the Fischer-Tropsch synthesis, hydroxy-octodecanesulphonates and arylalkylsulphonates such as diisobutylnaphthalene sulphonate and the like. The chlorination may be carried out under super-atmospheric pressure, continuously or batchwise, or in the presence of chlorination catalysts or with the aid of light.

When alkyl-substituted aromatic hydrocarbons are chlorinated at elevated temperatures under the influence of light the side-chain is chlorinated; at lower temperatures, however, the aromatic nucleus is principally chlorinated. By carrying out the chlorination first at atmospheric temperature and subsequently at a higher temperature under the influence of light, it is possible to introduce chlorine atoms into the nucleus and the side-chain.

In the examples: (*a*) vinyl chloride in aqueous emulsion is chlorinated to give trichloroethane; (*b*) a mixture of 1,2-dichloropropane and dichlorodipropyl ether are obtained by chlorinating propylene in aqueous emulsion; (*c*) monochlorobenzene with some *o*- and *p*-dichlorobenzene is obtained by chlorinating benzene in aqueous solution; and (*d*) toluene is chlorinated in aqueous emulsion to give monochlortoluene. German Specification 715,747 is referred to.—691,504, *Farbenfabriken Bayer.*

Apparatus for fusion reactions

Apparatus for carrying out fusion reactions of alkali metal arylsulphonates comprises an elongated reaction zone which is vertical or inclined to the vertical at an angle not exceeding 45° which opens at the upper end into an upper zone containing fused reaction

FIG. 5.

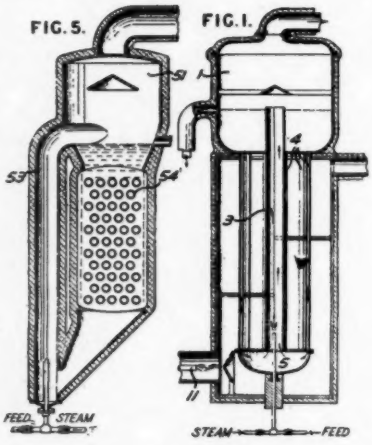


FIG. 1.

mixture; means for passing part of this fused material (preferably by gravity) to the lower portion of the elongated zone and for heating it during passage; and means for introducing an aqueous feed solution and, if desired, steam into the lower portion of the elongated zone. In this way the additional heat acquired by the fused material is used to convert the water of the aqueous solution to superheated steam and effect the fusion reaction, also the rapid rise of the superheated steam carries the fused material up through the elongated zone and back to the upper zone.

Means may also be provided for withdrawing excess of fused material and for carrying away steam with, in some cases, steam-volatile phenols produced by the reaction.

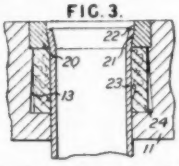
In the form of apparatus shown in Fig. 1, the upper zone 1 is connected to a header chamber 5 beneath the elongated zone 3 by conduits 4 heated by hot gases from a burner 11. In a modification, the elongated zone is placed to one side and the lower portions are bent round so as to pass directly into the lower portion thereof.

In a further modification (Fig. 5), the heating means consists of horizontal or inclined heat-exchange tubes 54, and the elongated zone 53 is bent horizontally at the upper end and enters the upper zone 51 tangentially to the wall thereof.—679,411, *Monsanto Chemical Co.*

Tube connections for heat-exchangers

A heat-exchanger tube is sealed in an opening in a tube plate 11 by a packing ring or rings 23 in a recess 24. This is closed by a metal ring 20 having a tapered bore 21 against which the end of the tube is flared. The ring bore has an outer cylindrical

FIG. 3.



portion 22 in which the flared tube end is a sliding fit.

The packing ring is of water-swellable fibre, and is so made that it expands radially more than it does axially. The packing recess 24 has an outwardly tapered wall 13 or the wall may be partly tapered and partly cylindrical. The packing ring 23 and retaining ring may both be screw-threaded to engage screw-threaded recesses.—695,390, *H. D. Heron.*

World News

GREAT BRITAIN

New Zealand heavy water project

Head Wrightson Processes Ltd. have received the order from Geothermal Development Ltd. for a heavy water plant to be erected in the Wairakei district of North Island, New Zealand. The formation of the latter company, in which the sole shareholders are the New Zealand Government and the United Kingdom Atomic Energy Authority, was reported in CHEMICAL & PROCESS ENGINEERING last month.

Members of Head Wrightson Processes' technical staff have visited New Zealand on various occasions to partake in discussions concerning this project with officials of the Government and Head Wrightson have been working with the Atomic Energy Research Establishment, Harwell, on the development of this scheme for the past few years.

In addition to the heavy water plant the Wairakei plant includes a power station, a compound unit and a water pumping station. Energy supply for the operation of this plant is by means of steam which is taken from hot springs at Wairakei, and separation of the heavy water is achieved essentially by distillation. The steam is also used in turbo-alternators to generate electric power. The heavy water plant has been designed so that each stage of distillation is performed in sets of fractionating columns operating in series, and careful consideration was given in the design of the plant to ensure that the appearance would be pleasing, merging harmoniously with the surrounding countryside.

Cooling water for the turbines is to be taken by pipes from the Waikato River and passed through sluice gates and screens before entering the pumps.

The new enterprise will fulfil Britain's need of heavy water as a moderator in atomic piles connected with power generation and also New Zealand's need for additional power.

Electromagnetically enriched isotopes

A conference on the production and and utilisation of electromagnetically enriched isotopes will be held at the Atomic Energy Research Establishment, Harwell, from September 13 to 16. Several leading members of the team responsible for the work on stable isotopes at Oak Ridge, U.S.A., are attending, while provisional acceptances have also been received from leaders of the separator groups in France, Holland and Denmark. Sessions will be included on the design and operation of large mass separators; ion source and collector problems, especially with high-beam current; separation of radioactive materials; chemical aspects of the production work; preparation of isotopic targets; developments in stable isotopes mass-analysis; and the utilisation of electromagnetically enriched isotopes.

The meeting should provide an opportunity for bringing together people concerned with the production and use of stable isotopes and should stimulate further applications.

Need for European Co-operation in Chemical Engineering Research

Winding up the three-day O.E.E.C. conference on 'The Functions and Education of the Chemical Engineer in Europe' in London recently, Sir Harold Hartley, K.C.V.O., F.R.S., said that it had emerged clearly that there is a most urgent need of more research. Chemical engineering research was an ideal field for European co-operation, which would bring economy of effort and of cost.

The first result of the conference, Sir Harold said, was that general agreement had been reached among the European countries represented as to the conception of chemical engineering as a fourth primary technology which now takes its place beside civil, mechanical and electrical engineering. There was one 'partial exception' to this agreement, namely, Germany, where they had chosen a different approach. However, Germany had a great tradition in the field which we know as chemical engineering.

Another point on which agreement was reached was the need to expand and multiply schools of chemical engineering in all the countries represented. There was also a need to foster a more general awareness of the importance of chemical engineering.

The conference was attended by over 300 delegates from 17 countries. During the discussions there were some lively exchanges, between eminent European authorities, on such subjects as the usefulness of pilot plants; the pattern of university training; the value of international exchange of chemical engineering students; as well as the different conceptions of 'chemical engineer' and 'process engineer.'

A report on this conference will appear in CHEMICAL & PROCESS ENGINEERING shortly.

New plant design firm

In order to widen the company's field of activity, Harold Moore & Partners (Engineers) Ltd. has been reformed and expanded under a new title. In future the firm will be known as H. E. Charlton Engineers Ltd. In the past the principal concern of the company has been with the design and construction of oil refining and petroleum chemicals plant. The intention now is to provide increased scope by undertaking work on various projects in the chemical and allied industries. With this in mind, the engineering staff has been considerably enlarged.

A separate section has been created to handle the detailed design of all forms of heat exchangers and a further section has been formed to deal with low-temperature plants for the fractional distillation of liquid air to produce oxygen, nitrogen and the rare gases. Another facet of the activities of the new company is the integration of steam, electrical and other power services, particularly for utilisation on refineries and chemical plants. Work of this nature is, in fact, being carried out at present.

Birwelco's new orders

New orders have been received by Birwelco Ltd. as follows:

(1) For the supply and erection of a furnace to be installed at the Grangemouth works of British Petroleum Chemicals Ltd. Order placed by E. B. Badger & Sons Ltd., of Battersea, London. This heater is of radiant convection design and is developed from the first vertical heaters, designed by the American engineer, de Florez, used in the oil refining industry in the United States.

(2) For the supply of three steam superheaters for installation at the Grangemouth plant of Forth Chemicals Ltd. Order placed by Monsanto Chemicals Ltd., of Wilton Road, London.

(3) For the supply of a radiant-type furnace for use as a charge heater in a U.O.P. platformer which is being engineered by Procon (Gt. Britain) Ltd., London. Order placed by Tankage et Transport S.A., of Antwerp, in whose refinery it will be used.

Incorporated Plant Engineers' dinner

The third annual dinner of the Incorporated Plant Engineers, held in London recently, was attended by about 160 members and guests. The guests included General Sir William Platt, G.B.E., K.C.B., D.S.O., a director of Mather & Platt Ltd.; Mr. Hugh Lyon, M.C., M.A., director of the Public

Schools Appointments Bureau; the Earl of Verulam; Sir Leslie Hollinghurst, G.B.E., K.C.B., D.F.C., chairman of the National Industrial Fuel Efficiency Service; Mr. F. M. Arkle, managing director, W. D. & H. O. Wills; and representatives of the technical press and other institutions.

Replying to a toast, the president, Mr. R. H. Cobbold, B.A.(CANTAB.), M.I.E.E., referred to the 'second industrial revolution' which is said to be taking place at present. In the last months, he pointed out, there have been announced schemes involving the expenditure of £1,900 million and, no doubt, in other circles considerable sums have also been approved which have not received publicity. 'It does make one wonder,' he said, 'where the brains are coming from to devote to the works which these vast expenditures are intended to provide. There can be no question that this is an era of the most intensive scientific and technical development.'

Film on industrial engineering

A new film, 'Planned for the Purpose,' produced by the British Electrical Development Association, deals with some of the most important aspects of industrial engineering, including the planning of new projects, plant siting, plant layout and building design. Various industrial techniques, such as mass, batch and unit production are shown on the work flow principle.

Third British Plastics Exhibition and Convention

British plastics manufacturers, with an output in 1954 nearly 30% above the previous year's figure and exports 25% up, have over-applied for space in the third biennial British Plastics Exhibition to be held at Olympia, London, from June 1 to 11, 1955.

There will be nearly 100 exhibitors showing the latest materials, plant, mouldings and fabricated goods, covering 33,000 sq. ft. A new exhibit will be a display of chemicals, moulding materials and mouldings shown by the Canadian Government as an example of plastics development in the Commonwealth.

Twenty-one papers will be presented at the convention, which runs from June 2 to 9.

New research laboratories for Murex

New extensions to the research laboratories of Murex Welding Processes Ltd. which have recently been completed represent a further stage in the growth of the laboratories which has taken place since the first portion of the laboratory block was built upon the present site in 1938. The Murex research department now covers an area of some 28,800 sq. ft. The new extensions are designed to provide facilities for the increasing volume of research work carried out by the department and reflect the great progress made by the welding industry in recent years.

★ PERSONAL PARAGRAPHS ★

★ Monsanto Chemicals Ltd. announce that **Dr. W. A. Hayward,** works manager at the Ruabon factory, is to be assistant to the managing director, **Mr. Philip A. Singleton.** His appointment is a preliminary to assuming, with their American associates, Monsanto Chemical Co., world-wide responsibilities as technical liaison officer for Monsanto Chemicals Ltd. and Monsanto Chemicals (Australia) Ltd. **Mr. E. V. Weekes,** formerly area manager at the Ruabon factory, is appointed works manager in succession to Dr. Hayward.

★ **Mr. D. Colbridge** has been appointed chief methods engineer of A.P.V.-Paramount Ltd. A member of the Steel Founding Productivity Team which visited the U.S.A. in 1949, he was previously chief methods engineer to the David Brown Foundries Co.

★ **Mr. H. West** has been appointed chief engineer and a member of the *Terylene* Council of Imperial Chemical Industries Ltd. He began his career with the Billingham Division of I.C.I. 27 years ago and has been with the *Terylene* Council since May 1953. He was connected with the design and construction of the I.C.I. nylon polymer plant and, during the war, built the high-octane aviation-spirit plant at Heysham for the Ministry of Aircraft Production.

★ **Mr. F. R. Mason** has been appointed general manager of Metropolitan-Vickers Electrical Export Co. Ltd. consequent on **Mr. F. J. E. Tearle's** appointment to the A.E.I. Overseas Group. At the same time, **Mr. G. H. Jolley** has been appointed principal representative of the export company at Trafford Park in succession to Mr. Mason.

★ British Filters Ltd. announce the appointment of **Mr. F. D. Murray** to the newly created post of general sales manager.

★ We announce with regret the death of **Mr. C. P. Lockton,** who has been chief engineer of Chloride Batteries Ltd. since 1949.

★ **General Sir Kenneth N. Crawford,** K.C.B., M.C., has been elected to the board of Cyanamid Products Ltd., the London subsidiary of the American Cyanamid Co. of New York.

★ Stainless Steel Vessels (London) Ltd. have appointed **Mr. R. R. Askew** (Huddersfield) as their technical representative for the Yorkshire, Northumberland and Durham areas. **Prof. W. Oliver** (Edinburgh) will continue to serve as Scottish representative.

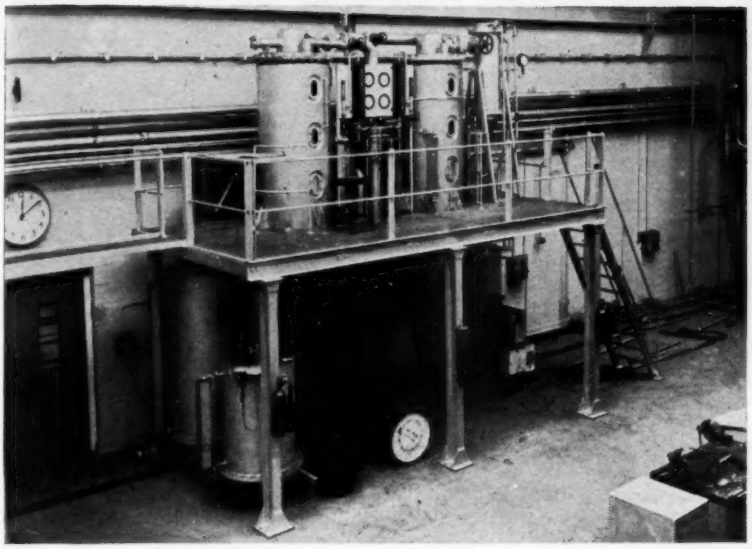
★ The board of directors of the reformed and expanded company now known as H. E. Charlton Engineers Ltd. (see note in this issue) comprises **Mr. H. E. Charlton** (managing director), **Mr. Harold Moore, Mr. E. Gibson, Mr. F. Wheatcroft** and **Mr. T. S. Saul.**

★ **Mr. J. S. Gerrard** has joined Metal & Pipeline Endurance Ltd. as senior engineer in charge of all corrosion mitigation schemes. From 1949 until recently he served in Kuwait as corrosion engineer of the Kuwait Oil Co.

★ The General Electric Co. Ltd. announce that **Mr. R. N. Millar,** lately chief mechanical engineer to the British General Electric Co. (Pty.) Ltd., Australia, has been appointed to take charge of the newly formed Industrial Atomic Energy Section which will develop designs of plant for the utilisation of atomic energy in power station generating equipment.

★ **Mr. George B. Beitzel,** president of the Pennsylvania Salt Manufacturing Co., U.S.A., recently expressed a wish to retire as chief executive later this year when he completes 25 years' service with the company. At the same time, he recommended that **Mr. William P. Drake** be appointed executive vice-president and elected to board membership. Both recommendations were approved by the board.

★ **Dr. H. G. Taylor,** director of research of the British Welding Research Association since 1947, has been elected president of the Society of Engineers. He has been associated with the Society since 1947 and has been a member of its council for seven years.



This double-effect evaporator, which was constructed in the establishment, gives an idea of the workshop facilities of the new Department of Chemical Engineering and Fuel Technology in the Newcastle Division of the University of Durham—the subject of an editorial note in this issue.

NORWAY

Hydroelectric and atomic power costs compared

After reporting the British Government's plan for building 12 atomic power stations in the next 10 years, the Oslo newspaper *Aftenposten* commented that the capacity of the 12 British atomic power plants will equal almost half the capacity of all the Norwegian hydroelectric plants, which at the end of 1954 was estimated at about 3,900,000 kw. The cost of building atomic power plants will be considerably greater than the cost of building hydroelectric plants in Norway. Norway's largest plant, Aura, will have a capacity of about 290,000 kw. and the cost was estimated last year at about £13 million. Roughly, one can say that atomic power plants will cost three to four times as much to build. The cost per unit of electricity from the atomic power plants is provisionally calculated at six-tenths of a penny. The price in Norway varies, but the price proposed for electricity for delivery to Stockholm under the terms of the Nea contract is about three-tenths of a penny a unit. The Nea contract refers to a proposed export of power from a plant to be built near Trondheim, Norway, to Stockholm, Sweden.

Aluminium plant for the north

Tentative plans have been drawn up between the Norwegian firm, Elektrokemisk A/s., and the municipal authorities of Mosjöen and Vefsn in the province of Nordland for the construction of an aluminium plant. The plant is to draw its power from the hydroelectric station at Rössaaga. The initial rate of production is planned at 20,000 tons p.a., but this is to be increased to 30,000 tons at a later stage of the development.

SWITZERLAND

International chemistry congress

The 14th International Congress for Pure and Applied Chemistry will be held in Zurich from July 21-27, 1955. The 18th Conference of the International Union for Pure and Applied Chemistry (I.U.P.A.C.) will be held from July 20-28.

So far, 1,334 members from the 31 countries belonging to I.U.P.A.C. have agreed to participate. The main speakers will be Prof. V. du Vigneaud of New York, Prof. Ch. Dufraisse of Paris, Prof. N. A. Nessmeyanow of Moscow, Prof. C. K. Ingold of London and Prof. K. Alder of Cologne.

BURMA

Chemical projects

Fourteen of the projects included in Burma's industrial development programme are considered by the Government as suitable for joint ventures with foreign firms. These include the heavy chemicals project (manufacture of sulphuric acid, caustic soda, nitric acid, chlorine, DDT, ammonia and chemical fertilisers); the synthetic fibre project (manufacture of viscose rayon, acetate rayon and vinylon); plastics (polyvinyl, urea formaldehyde and phenol formaldehyde); the manufacture of aluminium metal; and other projects.

BULGARIA

New soda works

The first units of Bulgaria's new 'Karl Marx' soda works came into operation recently. Further units are under construction and the firm will eventually become the second largest chemical works of Bulgaria. The manufacture is at present restricted to soda ash, but it is intended to take up the production of caustic soda and caustic potash at a later date.

AUSTRIA

Fertiliser output raised

The Oesterreichische Stickstoffwerke A.G. in Linz produced 544,000 tons of nitrogenous fertilisers in 1954, compared with 491,000 tons in 1953. A sulphuric acid and a superphosphate factory were brought into operation last October and it is expected that the output of superphosphates and other chemical products will increase considerably during 1955.

RUSSIA

Russian chemical equipment for China

Russia will get rare metals from Communist China under a trade agreement signed in Moscow recently providing for increased deliveries from both sides during 1955. A Tass announcement said Russia would provide equipment for ferrous metals and machinery plant, chemical and other factories. China will also get machine tools, oil boring equipment, tractors and oil products.

In exchange China will send wolfram, tin, molybdenum, jute, wool, raw silk, leather, soya beans, rice, vegetable oil, tea and cork.

AUSTRALIA

Aluminium plant in operation

Australia's first aluminium plant—and the only one in the Southern Hemisphere—has begun production at Bell Bay, Northern Tasmania. Initially, only alumina is being manufactured, but the plant will be fully operative shortly, turning out aluminium ingots at a rate of 10,000 tons p.a. While Malayan bauxite is being used at present, it is planned to process domestic ore eventually.

The plant is expected to meet the current level of demand for aluminium in the Commonwealth; however, it is

stated that industrial consumption is growing and considerable importations will be necessary within a few years.

SPAIN

Cement works expansion planned

The Ministry of Industry has authorised S.A. Tudela Veguino, of Abono, Oviedo Province, to expand capacity of their cement factory by 120,000 tons p.a. Total cost of the expansion will be 77,490,000 pesetas, of which 55,846,000 will be spent on imported material. The firm must present its final plan for the scheme to the Ministry within three months and the new plant must be installed and in operation within two years of the start of the work.

MEXICO

Production of nylon fibres planned

Celanese Mexicana is planning to produce nylon fibres in Mexico. Initial production has been set at 500,000 kilos p.a. Production is scheduled to start in January 1956, pending receipt and installation of machinery now on order.

Manufacture of nylon fibres in Mexico will eliminate the necessity for heavy imports of the product.

WESTERN GERMANY

Synthetic rubber production

A new plant for the production of synthetic rubber is planned by the Chemische Werke Huels at Marl in the Ruhr this year. The plant, which would produce cold rubber, would have an annual capacity of 30,000 tons. Total West German rubber consumption is now about 120,000 tons p.a.

Present East German synthetic rubber (Buna) production capacity is estimated at about 100,000 tons—about 30,000 tons more than at the end of the war. East German output is expected to exceed 70,000 tons this year.

Chemical import tariffs eased

West Germany's Government recently approved lower import tariffs for more than 30 items. The reductions are part of a Government programme to cut some 750 tariffs. The items include (in brackets the new duty rate):

Phosphoric acid and phosphoric acid anhydride (30% *ad valorem*); hydrazine and hydroxylamine (30%); uranium oxide (30%); natural radioactive elements and their natural radioactive isotopes (30%); isotopes of chemical elements and their organic and inorganic compounds, such as deuterium and heavy water (30%); salts and other organic or inorganic compounds of thorium and the metals yttrium and scandium (30%); and magnesium in various forms (30%).

The Leonard Hill Technical Group—April

Articles appearing in some of our associate journals this month include:

Food Manufacture—Preserved Foods for the Swedish Larder, 1; Peanut Butter, 1; The Browning of Salt-Cured White Fish; Progress Report: Vitamins, 2; Concentrated Vanillas and their Manufacture; The Smith-Ball Process; Preventive Maintenance of Canning Plant.

Manufacturing Chemist—The Nature of Wool Wax and its Economic Future; The Commoner Antihistamines; The Phytosterols of Soya—Chemistry, Properties and Uses; Silicones in Medicine and Pharmacy; Progress Reports: Cosmetics and Toilet Preparations, Antibiotics, Fertilisers and Plant Nutrients.

Paint Manufacture—The Economics of the Paint and Varnish Industry, 3—Scale and the Size of the Establishment; American Contributions to Phthalocyanine Technology; Service from the Small Manufacturer; The Study of Alkyd Resins; Butyl Titanate Heat- and Corrosion-resistant Paints.

Petroleum—Instrumentation and Automatic Control in Oil Refineries, 4; Plant Calculations for Petroleum Technologists, 2; Spectroscopy in the Oil Industry, 1.

Fibres—Fibre Prospects in the South Pacific; Fibre Cores of Steel Wire Ropes; Nylon Bonding Spindle Tapes; 'Dralon' Acrylic Fibre; Basic Research into the Mercerising of Yarn; Ardil Protein Fibre; Textile Machines of Today.

Atomics—Cosmic Radiation, 2; The Construction and Calibration of a 100-curie Gamma Irradiator.

Corrosion Technology—Corrosion Research Laboratories, 3—Corrosion Research at the National Bureau of Standards; Corrosion Problems in the Brewing Industry; Concrete and Corrosion; The Coating of Magnesium Alloys.

Dairy Engineering—The World's Largest Butter Factory; The Care and Maintenance of Cream Separators; Continuous Buttermaking; Kauri Pine Butter Churns; Tests on the Efficiency of Steam Sterilising Chests.

SOUTH AFRICA

Phosphate plant

The Phosphates Development Corporation (Pty.) Ltd. (Foskor) is expected to start operations next month at a new plant on the banks of the Olifants River in the north-eastern Transvaal. The plant will soon be supplying one-sixth of the Union's total requirements of rock phosphate and will eventually make the country independent of outside sources, according to the *Rand Daily Mail*.

A state-financed organisation with a capital of £1½ million, Foskor, was established in 1951 to exploit apatite-bearing ore at Phalaborwa, about 25 miles north-east of Mica. The phosphate concentrates produced will be processed into superphosphate fertilisers. At present, the Union is importing the bulk of its rock phosphate requirements.

NETHERLANDS

Fertiliser production by new process

The Netherlands fertilisers company, Mekog, has announced that it is to use a new process for the production of nitrogenous fertilisers based on the use of crude oil. It claims to be the first company in the world to use such a process. A new plant is to be set up at Velsen-Ymuiden and the company plans to expand annual output from 370,000 to 500,000 tons during the next few years. Costs involved are between 30 and 40 million guilders.

The company say that crude oil will be more economical to use than coal. However, the existing plants producing nitrogen by the coke furnace gas process will continue to operate.

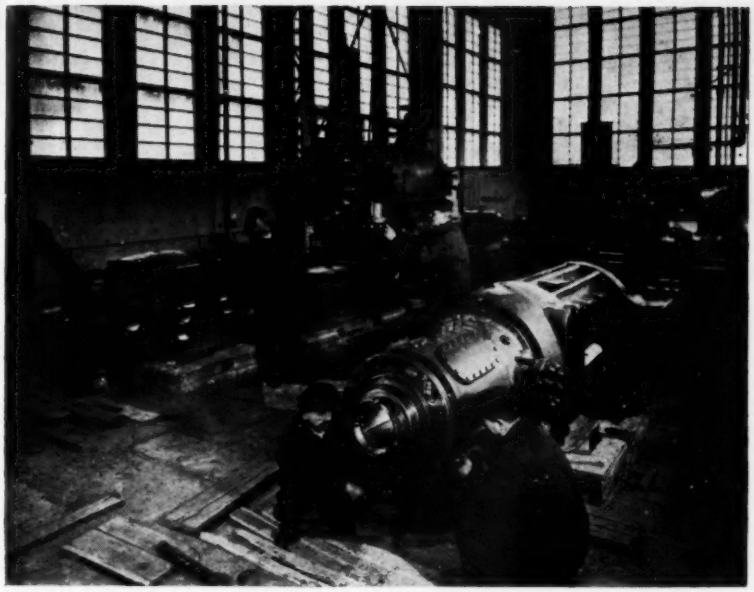
An increase in output is necessary due to continuously expanding fertiliser consumption. Sales prospects are favourable, both at home and abroad. Domestic nitrogen consumption is now around 900,000 tons p.a., against about 500,000 tons before the war. Exports—to 43 countries—are valued at 110 million guilders annually.

In co-operation with a Norwegian concern, the company is studying the problem of extracting potash from sea water. The two other nitrogen producers in the Netherlands—State Mines and the Azote Co.—are also planning to expand output.

CHILE

New oil refinery's progress

The new oil refinery at Concon commenced production on an experimental basis towards the end of November. When in full production at the beginning of 1955, it claims to be able to meet the total domestic needs of petrol amounting to 480 million litres annually and to supply 70% of kerosene consumption and all the diesel oil except that used by the copper mines in the north of Chile.



A new compressor being assembled in the nitrogen works at Pét, Hungary, mentioned on this page.

The refinery will also supply propane and butane gas for domestic use. Crude oil from the Magallanes oil wells will supply one-third of the refinery's needs, whilst the remainder will be imported.

Sulphuric acid

The Government is considering the construction at Atacama of another plant for the production of sulphuric acid. This would be on a smaller scale than the plant at Antofagasta which is expected to come into production in about eight months' time.

Freezing plant

The National Institute of Commerce (Inaco) has now completed the construction of a freezing plant at Talcahuano.

It has a storage capacity of 26,000 cu. m. and is capable of storing 200,000 cases of fruit, 1,500 tons of meat, 500 tons of butter and 3,000 cases of eggs.

HUNGARY

Plastics production plans

To solve the problem of developing a domestic plastics industry, Hungary set up a plastics research institute in 1950. It was given the task of finding sufficient raw materials inside Hungary to make the industry independent of imported raw materials. Recent statements in the Hungarian press indicate that production of a number of basic plastics materials will begin.

These include *Perspex*, which will be produced during 1955; insulating material for cold-storage works; and phenol-formaldehyde moulding powders. In 1956, home production of PVC will start, as well as the production of nylon, *Perlon* and *Kapron* yarn.

In collaboration with the inorganic section of Budapest Technical University, a method has been found of making silicon oil and lacquer.

Fertiliser plant modernisation

Hungary is spending £3 million on modernising and extending its fertiliser plant at the Pét nitrogen works. The whole of the old fertiliser section is being pulled down and a large, modern plant is being built this year. Power and water supply equipment is to be extended.

Demands for fertiliser have greatly increased in Hungary in the past year or two and industry has been unable to meet demands. It is hoped that the new plant, which is due for completion in August, will go a long way towards filling the gap.

PERU

Petroleum and fertiliser projects

Helios S.A., a company formed in 1953 by Peruvian and foreign capital to construct a petroleum refinery near the port of Pisco, south of Lima, has announced that its capital is to be increased to 100 million soles (nearly £2 million) and that the scope of the company has been expanded to include a synthetic fertiliser plant. This will be designed to produce fertiliser with a nitrogen content of 20.5%.

UNITED STATES

New petro-chemical plant

A $16-million chemical fertiliser manufacturing programme is being undertaken by Standard Oil Co., of California. Work will begin immediately on a new plant to manufacture ammonia and nitric acid, to be built at Richmond, California, as part of the company's general expansion in the field of chemicals derived from petroleum.

A subsidiary will construct a fertiliser plant to convert a substantial part of the ammonia-nitric acid output into agricultural fertilisers. Planned capacity of the combined facilities is 300 tons/day of ammonia.

Potash expansion

International Minerals & Chemical Corporation is expanding its potassium sulphate plant at Carlsbad, New Mexico. It will permit an increase in output of about 40,000 tons p.a. to 150,000 tons. Construction has already begun and increased production capacity will be available during the forthcoming fertiliser year beginning on June 1.

Titanium pigment project

E. I. du Pont de Nemours & Co. have announded a construction project to raise output of titanium dioxide pigments by 25% at its Edge Moor, Delaware, plant. The work is scheduled for completion late in 1956, but part of the new facilities will be producing before then.

Styrene monomer plant for Brazil

The Koppers Corporation Inc., the Firestone Tire & Rubber Corporation and Brazilian interests have formed a new company to construct and operate a styrene monomer plant at Cubatao, Brazil. Under the name of Companhia Braziliera de Estireno—Brazilian Styrene Co.—the group plans to erect a plant with an annual production capacity of 10,000,000 lb. of styrene monomer. The styrene, used in making polystyrene plastics, will go mainly to Brazilian manufacturers.

Koppers' Engineering and Construction Division will design the new plant, which will be situated on a 20-acre plot adjacent to a Government-owned refinery at Cubatao.

Tetraethyl lead manufacture

The selection of a plant site near Antioch, California, for the manufacture of tetraethyl lead—antiknock additive for gasoline—and *Freon* refrigerants was announced recently by the Du Pont Co. Options are being exercised on a tract of about 500 acres

approximately two miles east of Antioch on the San Joaquin River.

Air delivery of mechanical seals

Delivery and fitting of urgently needed mechanical seals within 5 hr. of receiving the plant engineer's telephone call is claimed by the Sealol-Flexibox organisation, who are using an aircraft specially bought for this purpose. This includes service to out-of-the-way oil refineries and chemical plants more than 400 miles from the regional headquarters at Tulsa, Oklahoma.

Two mechanical seal manufacturers, Flexibox Ltd. of Manchester, England, and the Sealol Corp. of Rhode Island, are concerned in this enterprise.

Anhydrous ammonia enterprise

Standard Oil Co. (Indiana) and Sinclair Refining Co. have organised a new firm to build and operate an ammonia unit at Hammond, Indiana.

The plant of this firm, Calumet Nitrogen Products Co., will be able to produce 300 tons/day of anhydrous ammonia, part of which will be converted into nitrogen solutions. By-product hydrogen from reforming of naphthas will be supplied from nearby Sinclair and Standard refineries.

Construction will start in April and operations are scheduled for May 1956.

Newsprint mill

The International Paper Co. is planning to erect a $20-million newsprint mill in the south, with a capacity of 100,000 tons p.a. The mill, whose exact location has not yet been determined, is expected to be ready to start operations in the second half of 1956.

The company has not produced newsprint in the United States in substantial quantities since the early 1930s, but Canadian International is among the world's largest producers. The firm operates nine pulp, paper and board mills and eight converting plants making paper bags, corrugated shipping containers and paper milk cartons in seven southern states. It also owns or holds under long-term lease nearly 3,500,000 acres of southern timber land.

Variable-ratio transformer. A six-page, illustrated brochure from the Vernistat Division, the Perkin-Elmer Corporation (U.S.A.), explains the construction and operation of the *Vernistat*, a new type of precision variable-ratio transformer. The *Vernistat*, it is stated, combines the resolution and linearity associated with multi-turn potentiometers with the low output impedance characteristic of variable auto-transformers. Included in the brochure are performance curves, application schematics in computer and servo systems, specifications of the 60- and 400-cp. types, and step-by-step drawings illustrating the combination auto-transformer and potentiometer mode of operation.

Dust collector. Publication 6506 from Sturtevant Engineering Co. Ltd. features the *Uniclone* dust collecting unit, which was designed primarily to serve individual machines, where they are installed at appreciable distances from each other, thus making a composite plant impracticable. It comprises a sheet-steel cylindrical casing, the bottom section containing a removable dust bin, which is sealed in its normal working position by means of a spring-loaded flexible cover. The removal of the cover is effected by movement of the two handles operating through cams. The dust-laden air entering the apparatus passes through a high-efficiency cyclone from which the dust is deposited into the bin.

MEETINGS

Institution of Chemical Engineers

April 13. 'Engineering in Chemical Plants,' by O. W. Murray, 7 p.m., Grosvenor Hotel, Chester. Joint meeting with the Institute of Petroleum and the Society of Chemical Industry.

April 16. 'Researches into Factors Affecting the Performance of Electroprecipitators,' by J. R. A. Lakey and W. Bostock, 3 p.m., the College of Technology, Manchester.

Society of Chemical Industry

Road and Building Materials Group

April 21. 'Recent Progress in the Chemistry and Technique of Lime Production,' by N. V. S. Knibbs, 6 p.m., Institution of Structural Engineers, 11 Upper Belgrave Street, London, S.W.1.

Chemical Society

May 2. 'The Nature of Adsorption Forces,' by Prof. H. C. de Boer. Joint meeting with the Institute of Chemistry of Ireland, the R.I.C. and the S.C.I., 7.45 p.m., University College, Dublin.

May 3. 'The Fundamental Principles of Catalysts,' by Prof. H. C. de Boer. (Time and place as above.)

May 6. 'The Fundamental Principles of Catalysts' (as above), 7.45 p.m., University College, Cork.

May 6. 'Kinetics of Some Organic Reactions,' by R. P. Bell, 5 p.m., Chemistry Department, The University, Southampton.

April 15. 'Polymerisation of the Vinyl Ethers,' by Prof. D. D. Ely, 5.15 p.m., Chemistry Department, The University, St. Andrews.

Institute of Petroleum

April 13. 'The Oil Industry—Its Place in the World and its Future,' by J. W. Platt, 5.30 p.m., 26 Portland Place, London, W.1.

INTERNATIONAL MEETINGS

April 14-15. Sixth Canadian High Polymer Forum, St. Catherines, Ontario, Canada, Chemical Institute of Canada.

April 18-20. Meeting, American Oil Chemists' Society, New Orleans.

April 25-28. Physical Society's 38th Annual Exhibition of Scientific Instruments and Apparatus, London.

May 1-4. Symposium on Nucleation Processes, American Institute of Chemical Engineers, Houston, Texas.

May 7-11. First International Congress of Ore Dressing, Goslar, Germany.